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OCTOBER 1992

INVESTIGATION OF

FORMER

UNDERGROUND

SOLVENT PRODUCT

TANKS

FACILITY AT

3200 MAIN STREET

KEOKUK, IOWA

Prepared for  
United Technologies Automotive  
Systems, Inc.  
Hartford, Connecticut  
July 1993

**Woodward-Clyde**



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**1.0****INTRODUCTION**

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This investigation described in this report was conducted as part of an ongoing site assessment involving former underground storage product tanks removed in October 1989 from the facility located at 3200 Main Street in Keokuk, Iowa. This investigation supplements Woodward-Clyde Consultants' (WCC's) initial Phase III Site Assessment Report dated July 17, 1991, and November 1991 Investigation Report dated February 24, 1992.

The field investigation was conducted by WCC on behalf of United Technologies Automotive Systems, Inc. (UTAS) from October 12, 1992 through November 6, 1992. Field work was performed in accordance with the procedures and protocols of the Phase III Site Assessment Work Plan dated February 22, 1991, prepared by Pollution Control Systems, Inc. and the UTAS amendments to the Work Plan dated September 20, 1991. Program modifications requested by the Iowa Department of Natural Resources (IDNR) (letter dated July 31, 1991) were also incorporated into the field investigation.

In the November 1991 Investigation Report it was postulated that solvents from the former tank area were migrating primarily through fill materials, traveling along the top of glacial till deposits and possibly also along storm sewer pipeline backfill materials. Follow-up recommendations contained in the report included the installation of 6 new monitoring wells, sampling and analysis of the 6 new wells plus four of the 16 existing wells, and the collection of soil samples from three shallow borings downgradient of the solvent product tank excavation. In a comment letter on the November 1991 report, dated August 14, 1992, the IDNR approved the recommended additional work, with the understanding that the extent of the groundwater contaminants required further delineation to the north of monitoring well MW-8 and east of monitoring well MW-1. These specific areas were not included in this investigation. However, additional delineation of the groundwater contaminants in these areas will be addressed at a later date in conjunction with the RCRA Facility Investigation (RFI) that is being conducted at the facility.



**2.0****BACKGROUND**

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Five underground solvent product storage tanks were removed from the fill area behind the main building of the Facility in October 1989 (Drawing 1). The facility history, tank history, and field investigation results since that time have previously been reported to the Iowa Department of Natural Resources (IDNR) in the following documents:

- Sheller-Globe Corporation, Keokuk Plant, Site Assessment Work Plan, May 3, 1990, prepared by United Technologies Automotive;
- Site Assessment Investigation, Sheller-Globe, 3200 Main Street, Keokuk, Iowa, August 9, 1990, prepared for United Technologies Automotive by Pollution Control Systems, Inc.;
- Phase II Site Assessment Subsurface Investigation, Sheller-Globe Facility, 3200 Main Street, Keokuk, Iowa, January 3, 1991, prepared for Sheller-Globe Corporation by Pollution Control Systems, Inc.;
- Phase III Site Assessment Report, Former Sheller-Globe Facility, 3200 Main Street, Keokuk, Iowa, July 17, 1991, prepared for Sheller-Globe Corporation by Woodward-Clyde Consultants; and
- November 1991 Investigation of Former Underground Solvent Product Tanks, Facility at 3200 Main Street, Keokuk, Iowa, February 24, 1992, prepared for United Technologies Automotive Systems, Inc. by Woodward-Clyde Consultants.

The reader is referred to those documents for details of the site history. In general, the five underground product storage tanks removed were:

- A 6,000-gallon toluene tank;
- A 300-gallon hexane tank;
- Two 1,500-gallon methyl ethyl ketone tanks; and



- A 4,000-gallon "Foam Head Cleaning Solvent" tank (mixture of methylene chloride; trichloroethylene; 1,1,1-trichloroethane; butanol; ethanol).

Since the tanks were removed in 1989, previous field investigations have included the performance of a soil gas survey, field screening and sampling of shallow soil borings, installation of groundwater monitoring wells in both the shallow fill material and in native glacial till soils, the performance of hydraulic tests on selected wells, and the sampling of monitoring wells.

The natural topography of the site was altered significantly during the site's development by placement of structural fill material which varies from 10 to 14 feet thick in the area of the former tanks' excavation to 0.5 to 11 feet in the vicinity of the Employee Parking Lot. The majority of the investigation area is occupied by facility structures or is paved with gravel, asphalt, or concrete. Site topography generally slopes from east to west.

The vadose zone of the site collectively consists of small patches of topsoil, a narrow band of alluvial sediments in the Employee Parking Lot area, and relatively thick sequence of glacial till deposits.

The structural fill appears to have been placed directly upon glacial till deposits in the vicinity of the former tanks' excavation without any grading. The fill material and the top portion of the glacial till deposits near the former excavation have volatile organic compounds (solvents) present at elevated levels. The current investigation further characterized details of geology and hydrogeology relevant to fate and transport of contaminants at the site. After completion of the October-November 1992 field investigation, the on-site groundwater monitoring well network now consists of 7 shallow monitoring wells screened in the structural fill material and 15 monitoring wells screened in the glacial till deposits.



## INVESTIGATION ACTIVITIES AND METHODS

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### 3.1 FIELD INVESTIGATION

Field work for this investigation was performed between October 12 and November 6, 1992.

Hannibal Testing Laboratories, Inc. (HTL) of Hannibal, Missouri provided drilling and monitoring well installation services for this investigation. All drilling and monitoring well installation activities were performed under the direction of WCC personnel. Groundwater and drill cutting samples were analyzed by Enseco-Rocky Mountain Analytical Laboratories (ENSECO) in Arvada, Colorado.

In accordance with the Occupational Safety and Health Administration (OSHA) requirements of 29 CFR 1910, a site-specific Health and Safety Plan was prepared by WCC (April 1992) and implemented during all phases of the field investigation.

#### 3.1.1 Soil Sampling

In the November 1992 report recommended the collection of soil samples from three shallow borings downgradient of the solvent product tank excavation. The three shallow borings were chosen to evaluate whether solvents were migrating preferentially in backfill materials along stormwater sewer pipelines located in the Employee Parking Lot (Drawing 1).

The shallow soil borings were drilled with a 2-inch diameter stainless-steel hand auger and field screened with an HNu for volatile organic vapors.

The boring logs for the soil borings are presented in Appendix A. Boring WCS-10 was placed behind a retaining wall, located south of the former tanks' excavation. The area behind the retaining wall was reportedly backfilled with sand. It was suspected that this sand might provide a migration pathway from the former tank excavation to the Employee Parking Lot area and to the backfill along the storm sewer lines in particular. At the location of WCS-10 an obstruction was encountered at a depth of 1.9 feet from the ground



surface (possibly a large rock, or concrete slab). Additional borings (WCS-10A and WCS-10B) were drilled on the slope behind the retaining wall, but they could not be advanced any deeper than 3.4 feet because of similar obstructions encountered. Soil encountered at each of the shallow boring locations consisted of sandy clays. No elevated HNu readings or visible contamination was observed in any of the borings, and therefore, no soil samples were collected from the shallow borings. Soil cuttings from the auger holes were returned to the respective holes.

The shallow depth of the borings prevented confirmation of sand backfill behind the retaining wall. Borings WCS-11 and WCS-12 (Drawing 1) were placed adjacent to two primary storm sewer lines crossing the Employee Parking Lot area and advanced to depths of 5.0 and 4.8 feet below the ground surface, respectively. No sand or other apparent coarse-grained backfill material was encountered in either boring. In addition, no elevated HNu readings or visible contamination were observed, and therefore no soil samples were collected from the shallow borings. Soil cuttings from the auger holes were returned to the respective holes.

### **3.1.2 Monitoring Well Installation**

The locations of the new monitoring wells (MW-13A, MW-13B, MW-16, MW-17A, MW-17B, and MW-18) were chosen to further delineate the lateral extent of groundwater contamination downgradient from the source area and to confirm suspected preferential migration routes of contaminants through the fill materials and along the top of the glacial till sequence. Well locations are shown on Drawing 1.

Monitoring well MW-13A was installed adjacent to existing well MW-13 and was screened in the fill material to provide data on contaminants in the fill. Monitoring well MW-13B was placed immediately to the southeast of MW-13 and was screened in the glacial till approximately 20 feet deeper than MW-13. Wells MW-13A, MW-13, and MW-13B provide a cluster that monitors the fill material, shallow till, and deeper till, respectively.

Monitoring wells MW-16 and MW-18 were installed downgradient of existing wells MW-13 and MW-11 on the southwest side of a stormwater sewer pipeline that runs across the middle of the Employee Parking Lot. Both wells were screened in the shallow glacial till



materials. The purpose of these well installations was to help delineate the lateral extent of contamination and evaluate the influence of the 36-inch storm sewer line on groundwater flow.

Monitoring wells MW-17A and MW-17B were installed adjacent to the southeast corner of the Cooling Pond. Well MW-17A was screened in the fill and well MW-17B in the deep glacial till. The main purpose of the MW-17 cluster was to evaluate the lateral extent of groundwater contamination and groundwater flow conditions near the Cooling Pond.

Construction details for the new and existing monitoring wells are summarized in Table 1 and the boring logs for the new borings and wells are presented in Appendix A. All monitoring well borings were drilled with a CME-75 drill rig using 4 1/4-inch I.D. (7 7/8-inch O.D.) hollow-stem augers, 2-inch diameter split-spoon samplers and an automatic 140-pound hammer.

All of the borings, except MW-13A, were sampled at 2.5-foot vertical intervals. Boring MW-13A was sampled continuously to a depth of 10 feet in order to identify the contact layer between the fill and glacial till sequences. Soil (unconsolidated deposits) from all of the borings was visually classified and logged by the WCC geologist.

The six new wells were constructed of 2-inch diameter, flush-coupled, Schedule 40 PVC pipe with 5-foot (in fill) or 10-foot (in till) sections of 0.01-inch commercially slotted, flush-coupled Schedule 40 PVC screen. All the wells were constructed in general accordance with the work plan. Well installation reports are provided in Appendix B. Following installation, the new monitoring wells were developed to increase yield and to remove materials which may have been introduced during drilling operations. A minimum of 5 to 15 well volumes, depending on the yield of each well, was evacuated from each of the new monitoring wells. Water quality parameters including temperature, pH, salinity, and conductivity were measured during development.

Drill cuttings associated with the installation of the six new monitoring wells were also screened in the field using an HNu. No elevated HNu readings were observed, however, one composite sample and one grab sample was collected from the cuttings and submitted for laboratory analysis to determine a method disposal for the cuttings.



### **3.1.3 Groundwater Sampling**

Groundwater sampling was conducted generally in accordance with the procedures and protocols specified in the Phase III PCS Work Plan and the UTAS amendment letter. Groundwater samples were collected using disposable polyethylene bailers from the 6 new monitoring wells and 4 existing wells (MW-10, MW-11, MW-13, and MW-14) on November 2, 1992. Seven of the 10 wells were purged on November 1, 1992 with the remaining 3 wells (MW-13 cluster) purged on the morning of November 2, 1992.

Samples collected from each well were placed in a cooler with ice and handled following proper chain-of-custody protocol.

Water quality parameters measured in the field included temperature, salinity, conductivity, and pH.

Copies of the field sample collection sheets are provided in Appendix C.

Quality assurance samples, including a trip blank and one blind duplicate sample from monitoring well MW-10 (labeled MW-19), were collected and submitted to the laboratory.

Groundwater samples were analyzed for volatile organic compounds by USEPA SW-846 Method 8240. The analytes included the Target Compound List (TCL) volatiles, plus methyl isobutyl ketone (4-Methyl-2-Pentanone), n-hexane, and butanol.

### **3.1.4 Surveying**

The locations of all newly installed monitoring wells were surveyed by WCC personnel. Ground surface elevations and top of casing elevations were measured relative to existing well MW-13. Horizontal distances were measured, relative to the previously installed wells, using a tape measure.



### **3.1.5 Resampling of MW-13 Well Cluster**

During the November 2, 1992 sampling event, an elevated concentration of methylene chloride was reported in the groundwater sample collected from well MW-13B. The reported presence of the methylene chloride in the well was suspected to be the result of contaminants brought into the well from the overlying contaminated upper glacial till during drilling activities. To verify this supposition, an additional round of groundwater samples was collected from the MW-13 well cluster on January 27, 1993. The three monitoring wells were purged on the evening of January 26, 1993 and sampled the following morning.

Disposal polyethylene bailers were utilized for sample collection and the samples were handled using proper chain-of-custody protocol.

The groundwater samples were once again submitted to Enseco for analysis. Analytes were the same as in the previous sampling event. Water quality parameters measured in the field included temperature, salinity, conductivity, and pH (Table 4).



## 4.0 RESULTS

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### 4.1 SITE HYDROGEOLOGY

The following characterization of the site hydrogeology is based on information from the on-site groundwater monitoring well network consisting of 7 shallow monitoring wells screened in the structural fill material and 15 monitoring wells screened in the glacial till deposits.

The area has been extensively filled. Both groundwater flow within the fill and the interaction of the groundwater in the fill with the underlying groundwater flow system are important to the evaluation of this site. The pre-fill surface is dominated by a former drainage way which extended northwesterly toward the head of the Cooling Pond near MW-17A and 17B. The pre-fill topographic low appears to have been in the area bounded on the northeast side by MW-17A, MW-17B, MW-13, MW-13A, and MW-13B, and on the southeast side by MW-18 and MW-16. The pre-fill land surface sloped downward towards this drainage from the northeast and southwest as shown on Drawing 3.

There are two topographically distinct areas of fill. One is located beneath the driveway and parking area south of the retaining wall. Wells MW-10, MW-11, MW-13, MW-13A, MW-13B, MW-14, MW-15, MW-16, MW-17A, MW-17B, and MW-18 are located in this area (see Drawing 1). The fill thickness encountered in MW-11, MW-15, and MW-14 was less than 2 feet indicating that the areas surrounding these monitoring wells has received little fill. MW-10, MW-13, MW-13A, MW-13B, MW-16, MW-17A, MW-17B, and MW-18 encountered 7 feet to 11 feet of a clay fill with little, if any, construction debris.

The other fill area is the relatively flat, elevated area north of the parking area and east of the Cooling Pond. The Chemical Storage Building, former tank location, railroad tracks, and wells MW-1, MW-2, MW-3, MW-4, MW-5, MW-6A, MW-6B, MW-7, MW-8, MW-9, and MW-12 are located in this area. This entire area has apparently been filled to depths ranging from 5.5 feet to 13 feet as evidenced by the thickness of fill encountered. The fill



consists primarily of clay with variable quantities of rock, brick, glass fragments, sand and wood. The density of the fill appeared to vary considerably. The fill overlies glacial till.

The glacial till at the facility is a clay till containing varying quantities of silt, sand, and gravel. Discontinuous sand layers are common in the glacial till in this area and also occur at the site.

The clay till at the site consists of medium to high plasticity clays with trace amounts of sand and gravel including thin sand seams less than 1 inch thick. Clayey sand was encountered in MW-13, MW-13B, and MW-17B at an approximate elevation of 605 feet above mean sea level (msl). This layer ranged from 1.5 feet to 3 feet in thickness at these locations. The upper portion of the till is generally oxidized with a yellow-brown color with gray mottling and contains fractures which are variably mineralized with calcium carbonate, or are sometimes filled with sand. Fractures were commonly encountered down to at least elevation 600 feet msl in the deeper monitoring well borings and were noted to elevation 595 msl in MW-13B.

Other changes were noted in the elevation 590 to 600 msl interval and below which likely influence groundwater flow in the area. In all of the monitoring well borings which penetrated to at least elevation 595 msl (MW-9, MW-10, MW-11, MW-13B, MW-16, MW-17B, and MW-18), the density of the till increased significantly and rather abruptly between elevations 591 msl and 598 msl. Fractures appear to be scarce below the top of the dense till. All of the monitoring wells in the parking lot area (MW-10, MW-13, MW-13B, MW-14, MW-16, and MW-17B) which penetrated to at least elevation 595, encountered a dense to very dense silty or clayey sand immediately overlying the dense clay till. The sand ranged from less than 1 foot to 4 feet in thickness. Only one boring (MW-7) in the fill area containing the Chemical Storage Building encountered this sand. It is not clear whether this is a continuous sand layer or several discontinuous layers occurring at approximately the same elevation. The base of this sand unit marks the boundary between the oxidized and fractured till and the less permeable lower till.

Monitoring wells screened in the fill material or at the fill-glacial till interface include MW-1, MW-2, MW-3, MW-4, MW-6A, MW-13A, and MW-17A. In addition, a group of wells (OP-1, OP-2, and OP-3) installed by Environmental Science and Engineering, Inc.



(ESE) in an area adjacent to two water storage reservoirs (Drawing 1) are also screened in this interval.

The remainder of the monitoring wells except MW-13B are screened partially or totally in the oxidized and fractured glacial till. MW-13B is screened in the hard, unoxidized till. A very dense clayey, silty sand was encountered at a depth of approximately 48 to 50 feet below ground surface in MW-13B. The water level measured in MW-13B on November 4, 1992, two days after purging and sampling, was approximately 6 feet below the stabilized level measured on January 26, 1993. The slow stabilization indicates that the clayey sand likely has a low permeability, possibly due to its density and fines content.

Groundwater flow in the fill near the Chemical Storage Building appears to be essentially horizontal and generally toward the southwest. However, the actual flow direction is likely to be somewhat radial in response to the lower topography to the south and west of this fill area. The horizontal gradient appears to steepen near the retaining wall and the fill slope. The water levels in the monitoring wells screened in the fill are higher than the water levels in the till wells in this area. This head differential in this area indicates the fill is more permeable than the underlying glacial till and is contributing recharge to the underlying glacial till flow system.

The groundwater flow direction in the glacial till is generally to the southwest. The potentiometric surface shown on Drawing 2 roughly parallels the till surface contours of the northeastern slope of the previously described apparent pre-fill drainage way. The data indicate that the gradient flattens considerably southwest of the pre-fill drainage way. However, it is possible that the groundwater in the glacial till actually discharges upward into the fill and flows generally northwest toward the Cooling Pond. Even though the water level in MW-14 is lower than the measured water level in MW-16, other evidence suggests discharge may be occurring in this area. This evidence includes:

- The water levels in all of the glacial till monitoring wells in the parking area, which encountered more than 2 feet of fill, have water levels above the elevation of the top of the till (MW-10, MW-13, MW-13B, MW-16, MW-17B, and MW-18);





- An upward gradient exists at the MW-13A/13B and MW-17A/17B clusters; and
- The apparent flattening of the hydraulic gradient southwest of the pre-fill drainage way.

Both the soil boring and hydrologic data indicate that the fill is likely to be more permeable than the underlying glacial till. Some portion of the groundwater in the fill beneath the Chemical Storage Building area recharges the underlying upper portion of the shallow glacial till then flows southwesterly. At least a portion of the flow in the glacial till then discharges to the fill in the area of the former drainage way. The discharge to the fill in this area might also be influenced to an unknown extent by the drainage pipes buried in the fill beneath the parking area. The exact locations, depths, and construction details of the buried pipes are not known with certainty. The surface elevation and depth of the Cooling Pond also likely has an influence on the flow pattern.

## 4.2 GROUNDWATER SAMPLING RESULTS

Groundwater samples were collected from the six newly installed wells and from four existing wells: MW-10, MW-11, MW-13, MW-14. All samples were analyzed for volatile organic compounds using SW-846 Analytical Method 8240. The results of the groundwater analyses are summarized in Table 2. Physical properties of the contaminants are summarized on Table 3. This section presents a summary of the general distribution patterns of the solvents.

The following volatile organic compounds were detected in groundwater samples collected during the November 1992 sampling event. Out of 10 wells:

- Methylene Chloride was detected in 3 wells at concentrations ranging from 1,900 to 91,000 µg/L;
- Trichloroethene was detected in 2 wells at concentrations ranging from 1,400 to 6,000 µg/L;
- Xylenes were detected in 2 wells at concentrations ranging from 2,900 to 8,600 µg/L;





- 1,2-Dichloroethene was detected in 2 wells at concentrations ranging from 5.8 to 6.0 µg/L; and
- 1,1-Dichloroethane; Ethylbenzene; Tetrachloroethene, Toluene, and 1,1,1-Trichloroethane were each detected in 1 well at varying concentrations.

The results of this sampling event are similar in many respects to those obtained in the November 1991 sampling event; i.e., methylene chloride, xylenes, and toluene were detected at elevated concentrations.

Wells MW-10 and MW-13 still exhibit concentrations of volatile organic compounds (VOCs) significantly higher than those in other wells sampled. Total VOC concentrations are almost 10 times higher in MW-13 (135,600 µg/L) than in MW-10 (15,000 µg/L, 11,400 µg/L in a duplicate sample).

None of the contaminants were detected in monitoring wells MW-14, MW-16, MW-17B, and MW-18, which are located downgradient and sidegradient of MW-10 and the MW-13 cluster. All of the wells are screened at the same stratigraphic level within the glacial till. This indicates that the lateral extent of contamination originating in the former tanks' area may have migrated only as far as the MW-13 cluster or a short distance beyond.

High concentrations of VOCs in wells MW-10 and MW-13, which are both screened within the glacial till, may be due to the preferential downslope migration of contaminants from the former tanks' excavation area. Lateral migration along the fill-till interface is also likely. In addition, the storm sewer pipes in the area, and backfill around them, may have also serve to alter migration pathways of the contaminants.

It is also apparent from the observed water levels that groundwater flow in the area of wells MW-14, MW-16, and MW-18 may be directed toward the northwest. As discussed in Section 4.1, there is evidence that discharge of the glacial till groundwater may be occurring in the pre-fill topographic low. This water then flows northwesterly toward the Cooling Pond, through the fill and/or the buried pipe backfill. Considering the potentially large areas of discharge from the till and the localized area of contaminated groundwater, considerable dilution of the contaminated water may occur in this area.





Total VOC concentrations in the other wells sampled are as follows: MW-11 - 6.0 µg/L; MW-13A - 10,900 µg/L; MW-17A - 12.8 µg/L; and MW-13B - 1,900 µg/L. The only contaminant detected in monitoring well MW-13B was methylene chloride. It was strongly suspected that methylene chloride was brought into the well, from the overlying contaminated layers, during drilling activities.

Monitoring well MW-13, which screens the upper portion of the glacial till, contained methylene chloride at a concentration of 63,000 µg/L. This zone is separated from the deeper water-bearing layers, which are screened by MW-13B, by a sequence of very hard and practically dry glacial till deposits that are considered an aquitard.

The MW-13 cluster (MW-13, MW-13A, and MW-13B) of monitoring wells was resampled on January 27, 1993. A comparison of analytical results for the two sampling events is presented in Table 4.

As a result of the resampling, methylene chloride was detected in monitoring well MW-13B at a concentration of only 5.9 µg/L. Taking into account the presence of methylene chloride in laboratory blanks and in the trip blank, this compound is probably a laboratory artifact and should be excluded as a chemical of concern in the deep glacial till.





## 5.0

CONCLUSIONS

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The main findings of the field investigation are described below:

- Groundwater flow is generally to the southwest. In addition, upward vertical gradients in the till were recorded in the MW-13 and MW-17 well clusters. These upward gradients should help to minimize both downward and off-site migration of contaminants in the till.
- Analytical results of groundwater obtained from the newly installed monitoring wells did not reveal any evidence of contaminant migration to the facility's southern property line. In addition, no contaminants were found in downgradient wells MW-14, MW-16, and MW-18. The low area of the parking lot between the MW-13 well cluster and wells MW-16 and MW-18 appears to be the likely downgradient boundary of the solvent plume.
- In comparison with analytical results obtained from the July 1992 and November 1991 sampling events, total VOC concentrations in monitoring wells MW-10 and MW-11 have decreased slightly.
- Based on analytical results obtained from monitoring well MW-17A, there are low levels of contaminants potentially migrating to the cooling pond.
- Shallow soil borings behind the retaining wall and adjacent to the storm sewer lines did not reveal any information in reference to deeper backfill materials. Field screening with an HNu did not indicate any elevated VOC readings. Fill material in the shallow boreholes looked similar to structural fill encountered at other locations on-site. It is believed that the shallow soil borings may not have been placed close enough to the primary storm sewer lines. At the present time, information concerning the exact locations of storm sewer lines is incomplete.



## 6.0

RECOMMENDATIONS

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No new monitoring wells are proposed at this stage of the investigation. The existing well network has sufficiently characterized the extent of contamination. Operation of the proposed soil vapor extraction (SVE) system should be initiated to remove the VOC contaminants in the soils which in turn should help improve groundwater quality. The ongoing monitoring program should be continued and include semiannual water level measurements, water sampling, and chemical analysis. This sampling program should continue during and for a limited period after operation of the SVE system to measure the success of the remediation system.

Storm sewer lines connected to the Cooling Pond should be sampled (water and sediment) and analyzed for the Target List Compounds, but only after the exact locations of the storm sewer pipes and their interconnections are known. This work is already planned in conjunction with the separate and ongoing RCRA Facility Investigation being conducted at the facility.

Finally, remediation of contaminated groundwater using pump and treat technology is not expected to be productive and is not recommended for the following reasons:

- The highest levels of contaminants are still in the shallow fill material. Any remedial efforts should initially focus on the removal of the contaminant source area (soils);
- Implementation of a pump and treat system at this time might actually draw contaminants from the original source area soils down deeper into the underlying tills as the water table is depressed; and
- Due to the low permeability of the glacial tills and localized extent of contamination, it is doubtful that contaminants associated with the source area will migrate very far during soil vapor extraction of the source.



## TABLES

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TABLE 1

## SUMMARY OF MONITORING WELL CONSTRUCTION DETAILS AND WATER LEVELS

Well I.D.	Date Installed	Elevation of Top of PVC Casing <sup>1</sup> (feet)	Elevation of Ground Surface (feet)	PVC Casing Diameter (inches)	Total Depth <sup>2</sup> (feet)	Screened Interval Elevation (feet)	Depth of Groundwater <sup>3</sup> (feet)	Groundwater Elevation (feet)
MW-1	October 1989	640.94	NA	4	14.21	625.94 - 635.94	5.35/5.22	635.59/635.72
MW-2	October 1989	640.34	NA	4	12.75	627.24 - 637.24	8.00/7.77	632.34/632.57
MW-3	October 1989	639.02	NA	4	16.77	622.32 - 632.32	11.28/11.37	627.74/627.65
MW-4	October 1989	640.94	NA	4	11.92	625.94 - 635.94	3.93/5.10	637.01/635.84
MW-5	November 1990	640.74	640.98	4	30.00	610.71 - 620.71	7.97/NA	632.77/NA
MW-6A	November 1990	641.13	641.43	2	13.94	627.26 - 637.26	6.58/6.35	634.42/634.78
MW-6B	November 1990	641.00	641.35	2	31.75	609.27 - 619.27	7.75/NA	633.38/NA
MW-7	November 1990	638.48	638.69	2	39.88	598.68 - 608.68	10.90/10.70	627.58/627.78
MW-8	November 1990	641.69	642.00	2	29.88	611.89 - 621.89	7.95/7.64	633.95/634.05
MW-9	May 1991	639.02	639.20	2	33.58	604.78 - 614.78	14.55/14.05	624.47/624.97
MW-10	May 1991	623.98	624.21	4	29.69	594.79 - 604.79	0.76/0.81	623.22/623.17
MW-11	May 1991	627.06	627.27	2	34.31	592.85 - 602.85	5.75/5.60	621.31/621.46
MW-12	May 1991	643.40	643.66	2	34.74	609.24 - 619.24	9.04/8.18	634.36/635.22
MW-13	November 1991	623.23	623.53	2	30.48	596.13 - 606.13	2.42/2.68	620.81/620.55
MW-13A	October 1992	622.90	623.43	2	10.06	613.33-618.33	2.87/2.29	620.03/620.61
MW-13B	October 1992	623.43	624.18	2	50.11	573.68-583.68	7.29/1.17	616.14/622.26
MW-14	November 1991	628.24	629.14	2	32.70	596.74 - 606.74	10.14/8.90	618.10/619.34
MW-15	November 1991	629.11	629.81	2	33.12	597.41 - 607.41	2.58/NA	626.53/NA
MW-16	October 1992	624.44	625.07	2	34.95	589.47-599.47	5.64/4.70	618.8/619.74
MW-17A	October 1992	620.29	620.67	2	10.33	610.47-615.47	3.98/3.32	616.31/616.97
MW-17B	October 1992	620.67	620.88	2	33.61	587.18-597.18	+2.52 <sup>4</sup> /+2.59 <sup>4</sup>	623.19/623.26
MW-18	October 1992	623.45	623.84	2	35.09	588.84-598.84	7.22/5.69	616.23/617.76
OP-1 <sup>5</sup>	May 1992	643.07	640.57	2	18.50	622.57-632.57	9.37/8.50	633.70/634.57
OP-2 <sup>5</sup>	May 1992	640.65	637.50	2	20.50	617.50-627.50	8.97/8.11	631.68/632.54
OP-3 <sup>5</sup>	May 1992	643.09	640.34	2	20.50	620.34-630.34	14.25/13.41	628.84/629.68

## Notes:

<sup>1</sup> All elevations are in feet above mean sea level.

<sup>2</sup> Total depths measured from top of PVC casing on May 30, 1991, November 5, 1991, and November 4, 1992

<sup>3</sup> Depth to groundwater measured from top of PVC casing on November 4, 1992, and January 26, 1993.

<sup>4</sup> Groundwater in MW-17B stands above ground surface. Riser extension and coupling used for groundwater level measurement.

<sup>5</sup> Monitoring wells installed by Environmental Science and Engineering, Inc. (ESE).

NA = Data not available.



TABLE 2

**SUMMARY OF ANALYTICAL RESULTS  
NOVEMBER 1992 GROUNDWATER SAMPLES  
(CONCENTRATIONS IN µg/L)**

Compound/Monitoring Well	MW-10/ MW-19 <sup>1</sup>	MW-11	MW-13	MW-13A	MW-13B	MW-14	MW-16	MW-17A	MW-17B	MW-18
1,1-Dichloroethane	ND (1,000)/ ND (1,000)	ND (5.0)	ND (2,500)	ND (620)	ND (85)	ND (5.0)	ND (5.0)	7.0	ND (5.0)	ND (5.0)
1,2-Dichloroethene	ND (1,000)/ ND (1,000)	6.0	ND (2,500)	ND (620)	ND (85)	ND (5.0)	ND (5.0)	5.8	ND (5.0)	ND (5.0)
Ethylbenzene	ND (1,000)/ ND (1,000)	ND (5.0)	ND (2,500)	2,300 <sup>2</sup>	ND (85)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
Methylene Chloride	12,000 D/ 10,000 D	ND (5.0)	91,000 D <sup>2</sup>	ND (620)	1,900 <sup>2</sup>	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
Tetrachloroethene	ND (1,000)/ ND (1,000)	ND (5.0)	2,700 D <sup>2</sup>	ND (620)	ND (85)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
Toluene	ND (1,000)/ ND (1,000)	ND (5.0)	33,000 D <sup>2</sup>	ND (620)	ND (85)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
1,1,1-Trichloroethane	1,200 D/ ND (1,000)	ND (5.0)	ND (2,500)	ND (620)	ND (85)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
Trichloroethene	1,800 D/ 1,400 D	ND (5.0)	6,000 D <sup>2</sup>	ND (620)	ND (85)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)
Xylenes (total)	ND (1,000)/ ND (1,000)	ND (5.0)	2,900 D <sup>2</sup>	8,600 <sup>2</sup>	ND (85)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)	ND (5.0)

**Notes:**

ND = Not detected; a numerical value in parentheses is the detection limit.

D = Identifies all compounds detected in the laboratory analysis after dilution of the sample due to the presence of target compounds.

<sup>1</sup> = MW-19 Designated number for duplicate sample from monitoring well MW-10.

<sup>2</sup> = All wells were sampled on November 2, 1992 and the MW-13 cluster resampled on January 27, 1993.

Analytical results for the January resampling are included in Table 4.

Non-detected compounds are not included.



**TABLE 3**  
**PHYSICAL PROPERTIES OF CONTAMINANTS**  
**DETECTED IN GROUNDWATER**  
**NOVEMBER 1992-JANUARY 1993**

Compound	Specific Gravity <sup>1</sup>	Dynamic Viscosity, cp <sup>2</sup>	Solubility in water, mg/L	Vapor Pressure, mm Hg
1,1-Dichloroethane	1.18	0.38	5,500 (20) <sup>3</sup>	182 (20) <sup>4</sup>
1,2-Dichloroethene	1.23	0.40	500 (20)	265 (20)
Ethylbenzene	0.87	0.69	161 (25)	9.5 (25)
Methylene Chloride	1.33	0.43	16,700 (20)	400 (24)
Tetrachloroethene	1.62	0.89	150 (20)	20 (25)
Toluene	0.82	0.59	535 (25)	28.4 (25)
1,1,1-Trichloroethane	1.34	0.86	1,495 (25)	123.7 (25)
Trichloroethene	1.46	0.57	1,110 (25)	57.8 (20)
Xylenes	0.86 - 0.88	0.62 - 0.81	146 - 175 (25)	6.6 - 8.7 (25)

**Notes:**

- <sup>1</sup> Specific gravity is the ratio of the compound mass to an equal volume of water.
- <sup>2</sup> Dynamic Viscosity, a sort of internal friction, is expressed in dyne-seconds per cm<sup>2</sup>, or poises. 0.01 poise = 1 centipoise (cp). Water has a dynamic viscosity of 1 cp at 20°C.
- <sup>3</sup> Numbers in parentheses are temperatures, C°.



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Trichloroethene	1.46	0.57	1,110 (25)	57.8 (20)
Xylenes	0.86 - 0.88	0.62 - 0.81	146 - 175 (25)	6.6 - 8.7 (25)

**Notes:**

- <sup>1</sup> Specific gravity is the ratio of the compound mass to an equal volume of water.
- <sup>2</sup> Dynamic Viscosity, a sort of internal friction, is expressed in dyne-seconds per cm<sup>2</sup>, or poises. 0.01 poise = 1 centipoise (cp). Water has a dynamic viscosity of 1 cp at 20°C.
- <sup>3</sup> Numbers in parentheses are temperatures, C°.



TABLE 4

**COMPARISON OF ANALYTICAL RESULTS  
DURING TWO SAMPLING EVENTS FOR  
MONITORING WELL  
MW-13 CLUSTER**

Monitoring Wells	MW-13		MW-13A		MW-13B	
Compounds, Parameters	11-02-92	01-27-93	11-02-92	01-27-93	11-02-92	01-27-93
Ethylbenzene	ND (2,500)	ND (5,000)	2,300	2,800	ND (85)	ND (5.0)
Methylene Chloride	91,000 D	63,000	ND (620)	ND (250)	1,900	5.9
Tetrachloroethene	2,700 D	ND (2,500)	ND (620)	ND (250)	ND (85)	ND (5.0)
Toluene	33,000 D	19,000	ND (620)	ND (250)	ND (85)	ND (5.0)
Trichloroethene	6,000 D	4,300	ND (620)	ND (250)	ND (85)	7.6
Xylenes (total)	2,900 D	3,000	8,600	9,800	ND (85)	ND (5.0)
Temperature, C°	15.0	7	15.2	7	12.9	12.0
pH	5.9	6.6	5.5	6.4	5.9	6.6
Salinity, ‰	0.5	2.0	0.25	3.0	0	1.5
Conductivity, µmhos/cm	1,150	1,300	1,150	2,350	830	1,150

**Notes:**

ND = Not detected; a numerical value in parentheses is the detection limit.

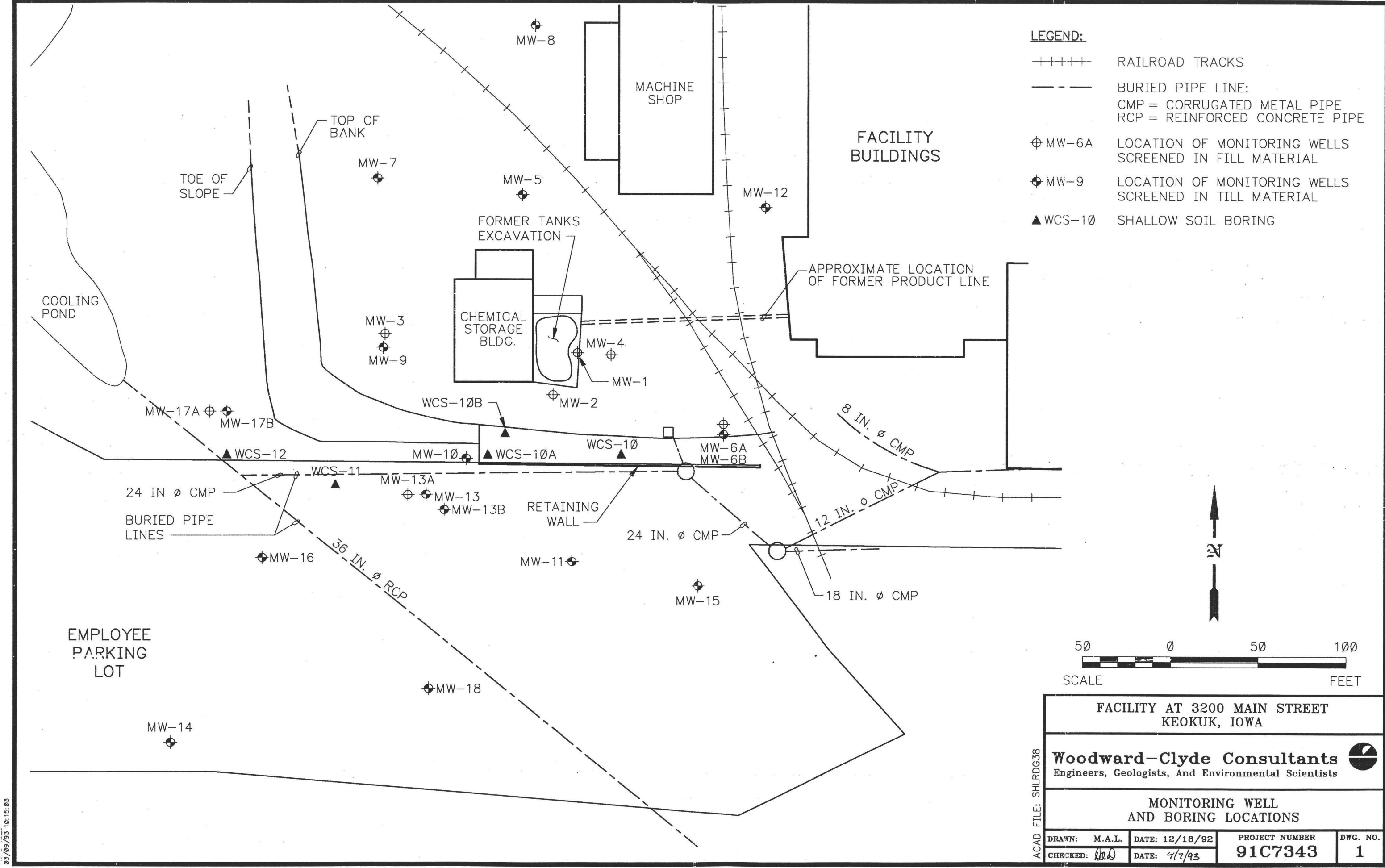
D = Identifies all compounds detected in the laboratory analysis after dilution of the sample due to the presence of target compounds. All concentrations are expressed in µg/L (ppb).  
Non-detected compounds are not included.  
Methylene chloride was detected in the January 1993 laboratory method blanks and trip blank at estimated concentrations of 1.2 µg/L to 5.1 µg/L.



## DRAWINGS

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FACILITY AT 3200 MAIN STREET  
KEOKUK, IOWA

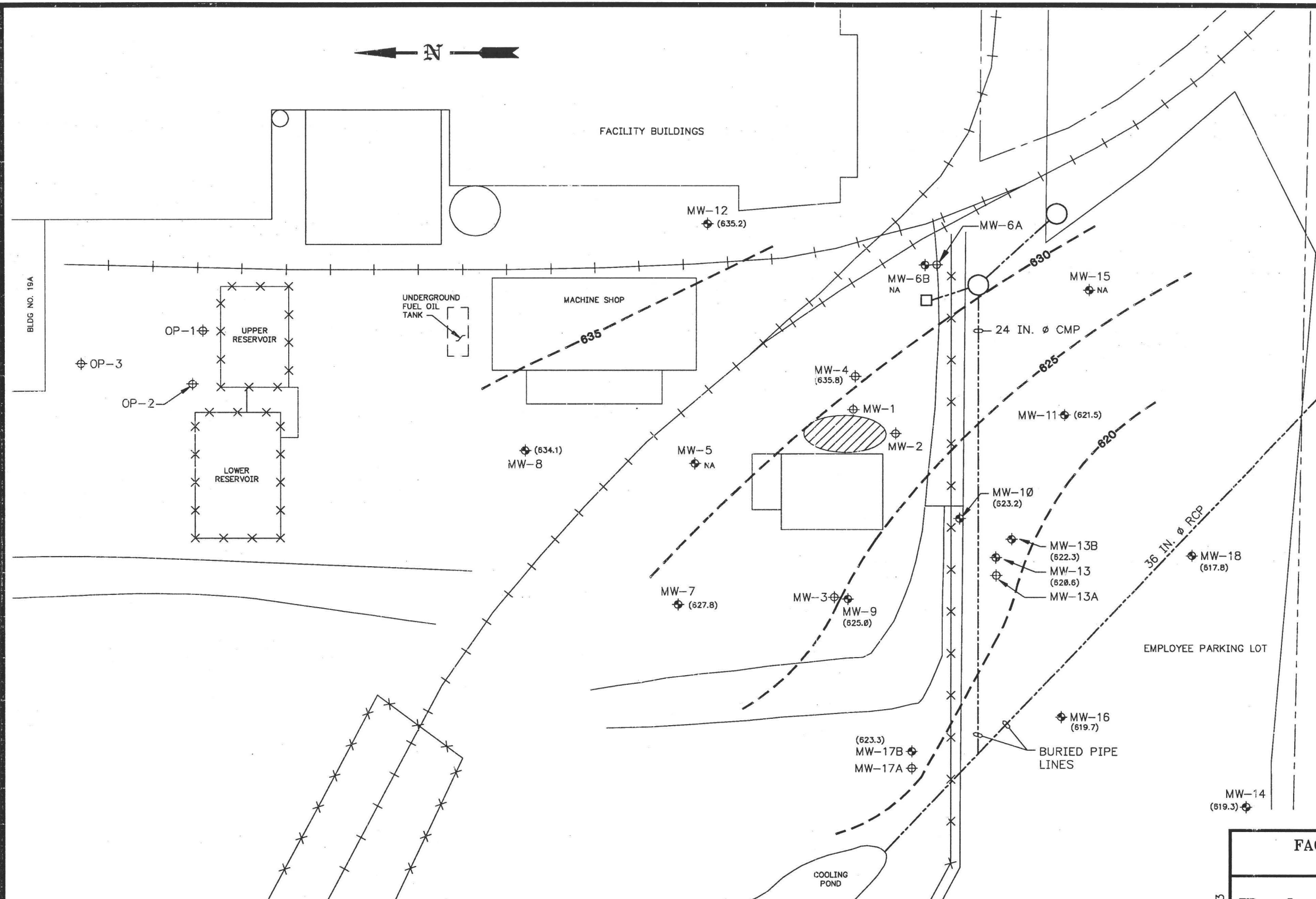
**Woodward-Clyde Consultants**  
Engineers, Geologists, And Environmental Scientists

**MONITORING WELL  
AND BORING LOCATIONS**



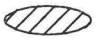
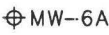
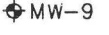
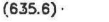
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CHECKED: <i>WED</i>	DATE: 4/7/93	91C7343	1

03/09/93 10:15:03





# **LEGEND:**

-  RAILROAD TRACKS
-  BURIED PIPELINE  
CMP = CORRUGATED METAL PIPE  
RCP = REINFORCED CONCRETE PIPE
-  FORMER TANK EXCAVATION AREA
-  MW-6A LOCATION OF MONITORING WELLS SCREENED IN FILL MATERIAL
-  MW-9 LOCATION OF MONITORING WELLS SCREENED IN TILL MATERIAL
-  (635.6) WATER LEVEL ELEVATION

## **NOTES:**

1. ALL SOIL BORING AND MONITORING WELL LOCATIONS ARE APPROXIMATE.
2. WATER LEVELS SHOWN IN PARENTHESES MEASURED IN FEET ABOVE MSL ON JANUARY 26, 1993.

FACILITY AT 3200 MAIN STREET  
KEOKUK, IOWA

**Woodward-Clyde Consultants**  
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GENERALIZED WATER LEVEL CONTOUR MAP -  
TILL MATERIAL - JAN. 26, 1993

DRAWN: M.A.L.	DATE: 12/18/92	PROJECT NUMBER	DWG. NO.
CHECKED: <i>[Signature]</i>	DATE: 6/26/93	91C7343	2

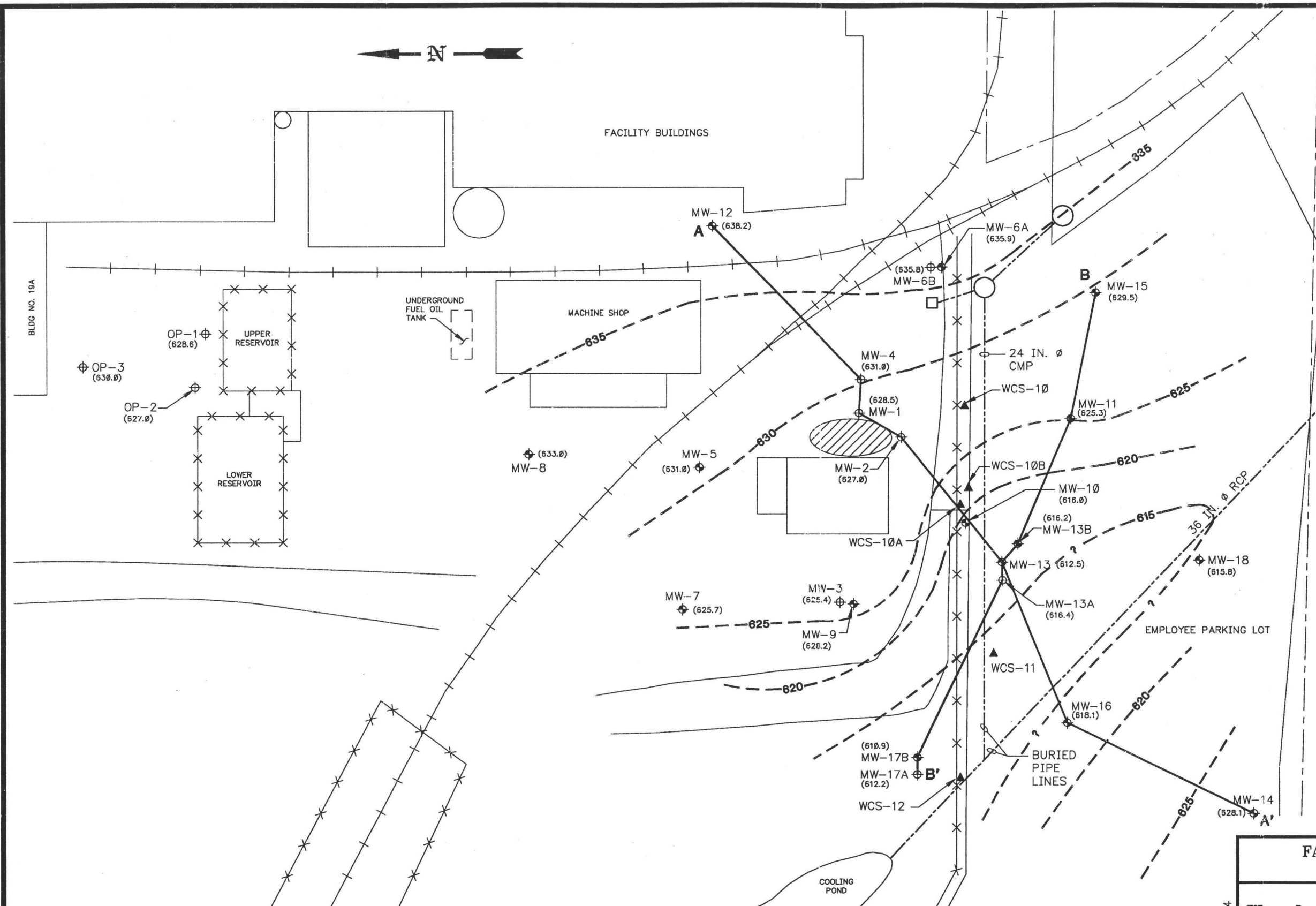
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SCALE FEET

06/25/93 15:52:08

D.R.T. SC: 1=1





- LEGEND:**
- RAILROAD TRACKS
  - BURIED PIPELINE  
CMP = CORRUGATED METAL PIPE  
RCP = REINFORCED CONCRETE PIPE
  - TANK EXCAVATION AREA
  - ⊕ MW-6A LOCATION OF MONITORING WELLS SCREENED IN FILL MATERIAL
  - ⊕ MW-9 LOCATION OF MONITORING WELLS SCREENED IN TILL MATERIAL
  - ▲ WCS-10 SHALLOW SOIL BORINGS
  - (635.6) TOP OF GLACIAL TILL - SURFACE ELEVATION

- NOTES:**
1. ALL SOIL BORING AND MONITORING WELL LOCATIONS ARE APPROXIMATE.
  2. SEE DRAWING 4 FOR CROSS SECTION ALONG A-A'.
  3. SEE DRAWING 4 FOR CROSS SECTION ALONG B-B'.

FACILITY AT 3200 MAIN STREET  
KEOKUK, IOWA

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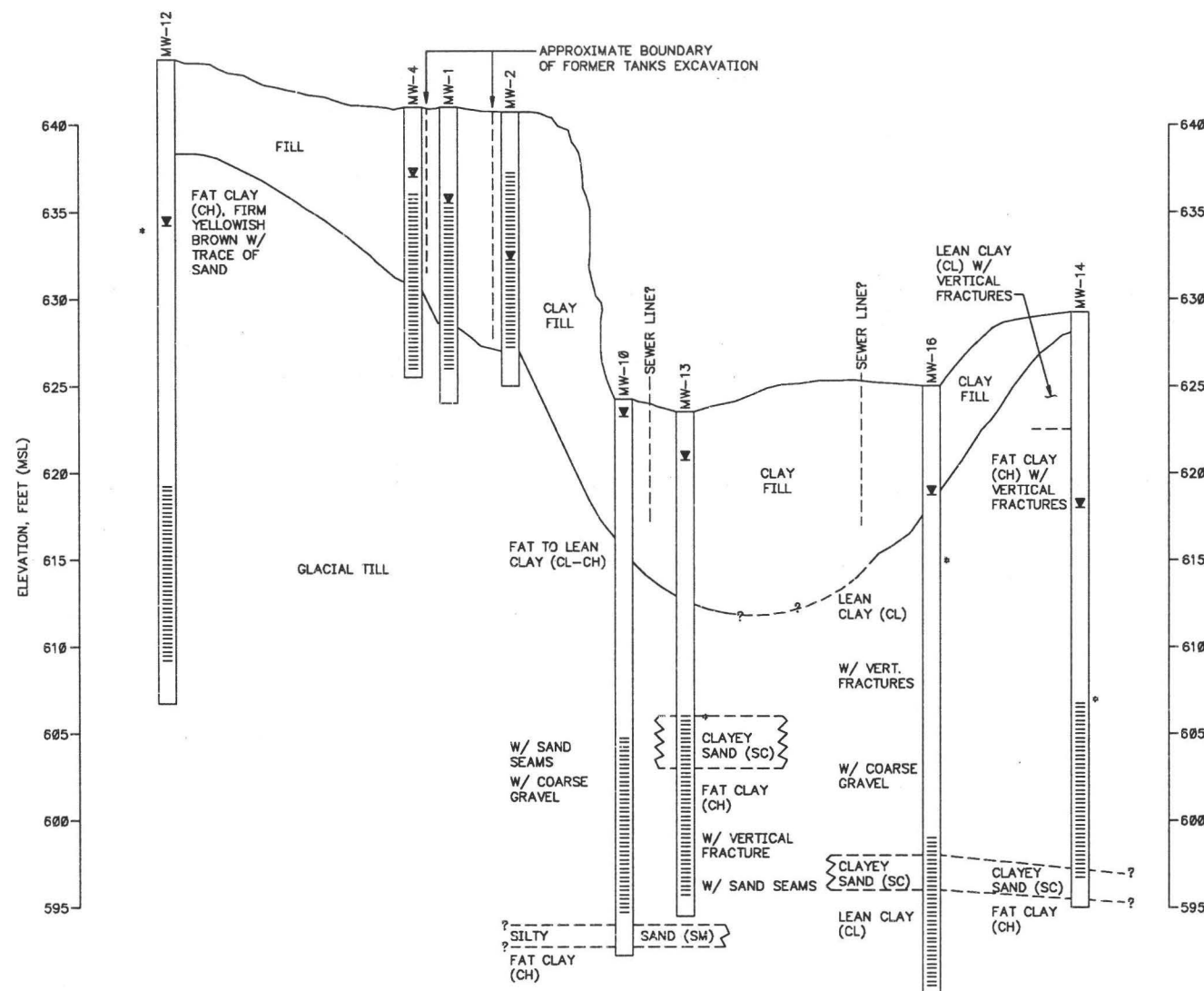
GENERALIZED TILL SURFACE  
CONTOUR MAP

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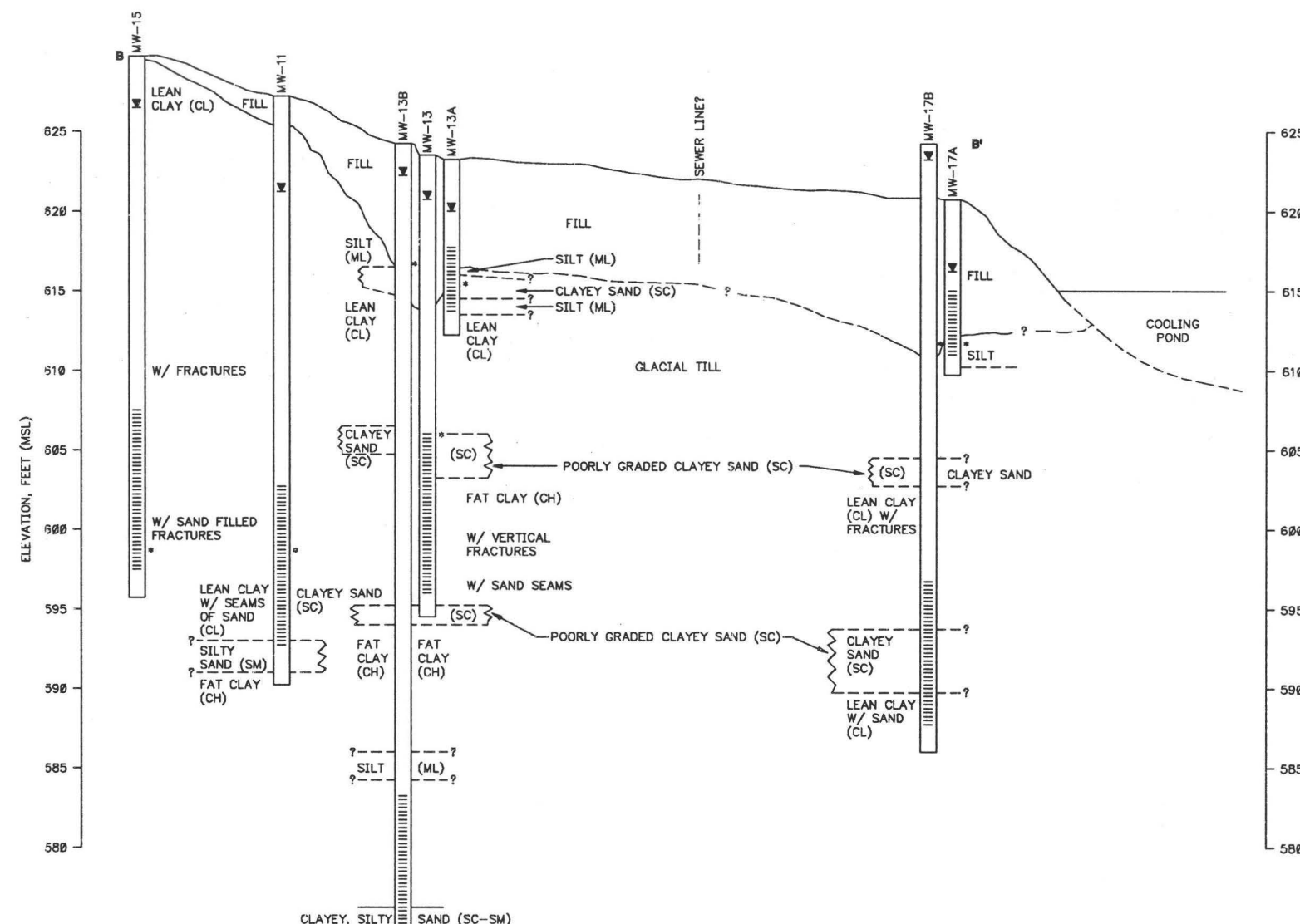
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M.A.L. SC: 1=1





CROSS-SECTION A-A'



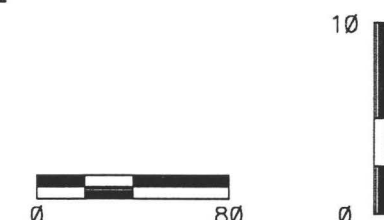
CROSS-SECTION B-B'

**LEGEND:**

- \* DEPTH AT WHICH WATER WAS ENCOUNTERED DURING DRILLING
- ▬ STATIC WATER LEVEL WITHIN WELLS AS MEASURED ON NOVEMBER 4, 1992 (WATER LEVEL WITHIN MW-13B WAS MEASURED ON JANUARY 26, 1993)

**NOTES:**

1. REFER TO DRAWING 3 FOR CROSS-SECTION LOCATIONS
2. GEOLOGIC CONDITIONS SHOWN AWAY FROM MONITORING WELLS ARE INTERPRETIVE.



SCALE IN FEET

FACILITY AT 3200 MAIN STREET  
KEOKUK, IOWA

**Woodward-Clyde Consultants**  
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FILL/TILL CROSS-SECTIONS

DRAWN: M.A.L.]	DATE: 03/09/93	PROJECT NUMBER	DWG. NO.
CHECKED: <i>gaw</i>	DATE: 6/26/93	91C7343	4

ACAD FILE: FIG-1A



**APPENDIX A**  
**BORING LOGS**

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# BORING LOG

WCS-10

PROJECT NAME Sheller-Globe (3200 Main Street)  
 PROJECT LOCATION Keokuk, Iowa  
 LOGGED BY G. Papinako DRILLED BY D. Kocour  
 SURFACE ELEVATION 632.9 ELEVATION DATUM NGVD  
 OBSERVATIONS \_\_\_\_\_  
 GROUND WATER No water detected ATD

SHEET 1 of 1  
 PROJECT NO. 91C7343  
 TASK NO. 0220  
 DATE 10/14/92  
 RIG Hand auger

DEPTH, ft.	SAMPLE				DESCRIPTION	SYMBOL	ELEVATION	FIELD NOTES
	TYPE	RECOVERY	RESISTANCE	PP, KSF				
0					TOPSOIL			Boring advanced w/ 2-inch-dia stainless steel hand auger
					LEAN CLAY WITH SAND (CL), firm, dark brown, with trace of coarse gravel, with trace to little fine grained sand, with abundant roots and root hairs (Fill)			HNU = BG  WC > PL
					Becoming light brown with light gray mottling, with iron oxides (?) staining, with coarse gravel, with root hairs			
					Becoming soft to firm. light brown, with light gray mottling			Refusal: boulder encountered @ depth of 1.9 ft.
								B.O.B. 1.9 ft.
								Boring backfilled w/ auger cuttings
							630	
5								







# BORING LOG

WCS-10A

PROJECT NAME Sheller-Globe (3200 Main Street)  
 PROJECT LOCATION Keokuk, Iowa  
 LOGGED BY G. Papinako DRILLED BY D. Kocour  
 SURFACE ELEVATION 629.8 ELEVATION DATUM NGVD  
 OBSERVATIONS \_\_\_\_\_  
 GROUND WATER No water detected ATD

SHEET 1 of 1  
 PROJECT NO. 91C7343  
 TASK NO. 0220  
 DATE 10/18/92  
 RIG Hand auger

DEPTH, ft.	SAMPLE				DESCRIPTION	SYMBOL	ELEVATION	FIELD NOTES
	TYPE	RECOVERY	RESISTANCE	PP, KSF				
0					TOPSOIL			Boring advanced w/ 2-inch-dia stainless steel hand auger
					FAT CLAY WITH SAND (CH), firm, light brown with dark brown mottling, with trace fine grained sand, with iron oxides nodules, with roots, root hairs (Fill)			
					VOID			HNU = BG
					LEAN CLAY WITH SAND (CL), firm, light grayish brown, with little fine grained sand, with little gravel, with pieces of slag and coal (Fill)			HNU = BG
								Refusal: @ 2.2 ft. (Concrete slab ?)
								B.O.B. 2.2 ft.
								Boring backfilled w/ auger cuttings
5							625	





# BORING LOG

WCS-10B

PROJECT NAME Sheller-Globe (3200 Main Street)  
 PROJECT LOCATION Keokuk, Iowa  
 LOGGED BY G. Papinako DRILLED BY D. Kocour  
 SURFACE ELEVATION 633.3 ELEVATION DATUM NGVD  
 OBSERVATIONS \_\_\_\_\_  
 GROUND WATER No water detected ATD

SHEET 1 of 1  
 PROJECT NO. 91C7343  
 TASK NO. 0220  
 DATE 10/18/92  
 RIG Hand auger

DEPTH, ft.	SAMPLE				DESCRIPTION	SYMBOL	ELEVATION	FIELD NOTES
	TYPE	RECOVERY	RESISTANCE	PP, KSF				
0					TOPSOIL			Boring advanced w/ 2-inch-dia stainless steel hand auger
					LEAN CLAY WITH SAND (CL), firm, gray and yellowish brown, with trace to little of fine grained sand, with root hairs, with trace of slag (small fragments) (Fill)			HNU=BG
					Becoming light yellowish brown with little fine gravel			HNU=BG
					Becoming soft to firm			HNU=BG
					With small lumps of gray clay			
					With roots, bark, pieces of wood			
							630	Refusal: @ 3.4 ft.
								B.O.B. 3.4 ft.
								Boring backfilled w/ auger cuttings
5								



# BORING LOG

WCS-11

PROJECT NAME Sheller-Globe (3200 Main Street)  
 PROJECT LOCATION Keokuk, Iowa  
 LOGGED BY G. Papinako DRILLED BY D. Kocour  
 SURFACE ELEVATION 622.3 ELEVATION DATUM NGVD  
 OBSERVATIONS \_\_\_\_\_  
 GROUND WATER No water detected ATD

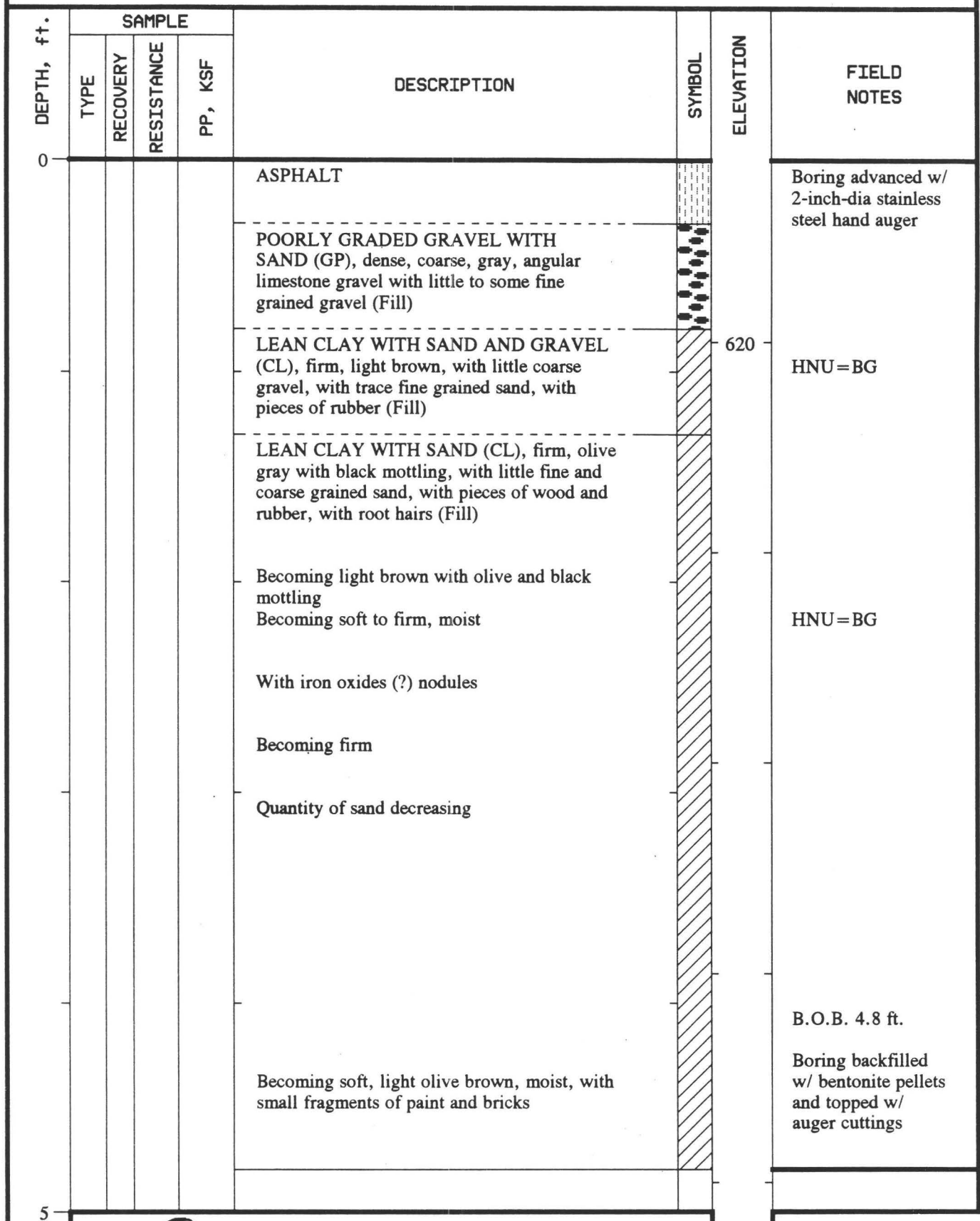
SHEET 1 of 1  
 PROJECT NO. 91C7343  
 TASK NO. 0220  
 DATE 10/14/92  
 RIG Hand auger

DEPTH, ft.	SAMPLE				DESCRIPTION	SYMBOL	ELEVATION	FIELD NOTES
	TYPE	RECOVERY	RESISTANCE	PP, KSF				
0					CONCRETE			Boring advanced w/ 2-inch-dia stainless steel hand auger
					POORLY GRADED GRAVEL WITH SAND AND CLAY (GP), dense, light gray, coarse with little fine grained sand, with trace of clay (Fill)			HNU=BG
					Quantity of clay increasing			
					LEAN CLAY WITH SAND (CL), firm, olive brown with red, dark brown, white mottling, with trace of fine grained sand, with pieces of wood, with fragments of paint (?) (Fill)			HNU=BG
					With trace of mica Becoming light brown with bluish gray mottling, with iron oxides (?) nodules		620	
					With fragments of lime (?) With seams and partings of dark brown clay			HNU=BG
					Becoming dark brownish gray			
					Quantity of sand increasing			
					Becoming moist with bright olive mottling, with trace of coarse gravel			
5								B.O.B. 5.0 ft.  Boring backfilled w/ auger cuttings



## WCS-12

SHEET 1 of 1  
PROJECT NO. 91C7343  
TASK NO. 0220  
DATE 10/14/92  
RIG Hand auger





## MW-13A

SHEET 1 of 1  
PROJECT NO. 91C7343  
TASK NO. 0220  
DATE 10/18/92  
RIG CME-75

**Figure No. A-**



# BORING LOG

**MW-13B**

PROJECT NAME Sheller-Globe (3200 Main Street)  
 PROJECT LOCATION Keokuk, Iowa  
 LOGGED BY G. Papinako DRILLED BY T. Clay (HTL)  
 SURFACE ELEVATION 624.2 ELEVATION DATUM NGVD  
 OBSERVATIONS \_\_\_\_\_  
 GROUND WATER Water enters borehole at 7.3'

SHEET 1 of 3  
 PROJECT NO. 91C7343  
 TASK NO. 0220  
 DATE 10/17/92  
 RIG CME-75

DEPTH, ft.	SAMPLE			DESCRIPTION	SYMBOL	ELEVATION	FIELD NOTES
	TYPE	RECOVERY	RESISTANCE PP, KSF				
0				CONCRETE			Boring advanced w/ 4 1/4-inch I.D. HSA, 2-inch dia. split spoons, and 150 lbs automatic hammer (penetration without strokes) HNU=0.4; BG=0.2 ppm HNU=0.3; BG=0.2 ppm  Water enters ATD (7.3')  HNU=BG (Alluvium)  (Modified till)  HNU=BG  HNU=BG  HNU=BG  HNU=BG  (Till)  HNU=BG
	S		2 4 5	LEAN CLAY WITH SAND AND GRAVEL (CL), firm, light brown, olive and dark gray, with little coarse gravel (limestone), with little fine grained sand, with root hairs (Fill)			
				Becoming soft		620	
				Becoming dark olive gray			
5	S		2 4 7	With lumps of rotten wood			
				Becoming light olive gray, moist			
	S		0 1 2	SILT (ML), very soft, dark gray, low plastic, with abundant root hairs, with little clay in fines, with trace of coarse grained sand		615	
10	S		0 0 0	LEAN CLAY WITH SAND (CL), very soft, light gray with brown mottling, with trace of fine grained sand, with iron oxides (?) mottling			
				Becoming soft, quantity of iron oxides (?) increasing, with abundant root hairs			
	S		2 3 4			610	
15	S		0 2 4	With iron and manganese oxides (?) staining, with calcareous nodules, with trace of coarse gravel			HNU=BG  HNU=BG  HNU=BG  HNU=BG  (Till)  HNU=BG
				Becoming light yellowish-brown Quantity of sand increasing			
	S		7 8 4	CLAYEY SAND (SC), medium dense, dark yellow, fine grained, poorly graded, with little to some clay as matrix		605	
20	S		5 7 10	LEAN CLAY WITH SAND (CL), soft to firm, yellowish-brown, with trace of coarse grained sand, with abundant closely spaced vertical fractures infilled with calcareous matter			
				With trace of fine and coarse gravel			
	S		2 4 7			600	
				Becoming yellowish-brown and bluish-gray			
25							



# BORING LOG

MW-13B

PROJECT NAME Sheller-Globe (3200 Main Street)  
 PROJECT LOCATION Keokuk, Iowa  
 LOGGED BY G. Papinako DRILLED BY T. Clay (HTL)  
 SURFACE ELEVATION 624.2 ELEVATION DATUM NGVD  
 OBSERVATIONS \_\_\_\_\_  
 GROUND WATER Water enters borehole at 7.3'

SHEET 2 of 3  
 PROJECT NO. 91C7343  
 TASK NO. 0220  
 DATE 10/17/92  
 RIG CME-75

DEPTH, ft.	SAMPLE			DESCRIPTION	SYMBOL	ELEVATION	FIELD NOTES
	TYPE	RECOVERY	RESISTANCE				
25	S	2 7 11		LEAN CLAY WITH SAND AND GRAVEL (CL), soft to firm, yellowish-brown and bluish-gray, with little coarse and fine grained sand, with trace of fine and coarse gravel, with vertical fractures infilled with calcareous clay, with seams, parting and thin beds (1-1.5 inch) of fine grained sand, with root hairs Becoming hard			HNU = BG  Drilling stopped 10-16-92 Drilling resumed 10-17-92 HNU = BG
	S	9 23 38				595	
30	S	7 16 18		CLAYEY SAND (SC), very dense, grayish-yellow, fine grained, poorly graded, with some clay as matrix Becoming mostly medium grained and dense			HNU = BG
	S	2 18 19		LEAN SANDY CLAY (CL), firm to hard, dark olive, bluish-gray, yellowish-brown, with disseminated sand, with seams and partings of sand, with trace of coarse gravel, with veinlets of calcite With layer (4 inch thick) of dense, grayish-yellow, medium grained, poorly graded, clayey sand		590	HNU = BG
35	S	2 12 18		LEAN CLAY WITH SAND (CL), firm to hard, dark gray, with trace of disseminated fine grained sand, with trace of fine and coarse gravel Becoming dark gray and yellowish-brown (irregularly distributed), with seams and partings of fine grained sand			HNU = BG
	S	4 12 18				585	
40	S	4 14 19		SILT (ML), dense, dark gray, low plastic, with trace of clay, with trace of very fine grained sand, with trace of mica LEAN CLAY WITH SAND AND GRAVEL (CL), firm to hard, dark gray with olive brown zones, with little disseminated fine grained sand, with trace of fine gravel With partings of fine grained sand, with little silt in fines, with trace of mica			HNU = BG
	S	6 18 37				580	
45	S	5 19 36		With layer (5 inch thick) of dark gray, fine grained, poorly graded, clayey sand			HNU = BG
	S	5 24 60		CLAYEY, SILTY SAND (SC-SM), very dense, dark gray, very fine to fine grained, poorly graded, with little to some clay and silt in fines, with trace of mica		575	HNU = BG
50							



Woodward-Clyde Consultants

Figure No. A-



# BORING LOG

MW-13B

PROJECT NAME Sheller-Globe (3200 Main Street)  
 PROJECT LOCATION Keokuk, Iowa  
 LOGGED BY G. Papinako DRILLED BY T. Clay (HTL)  
 SURFACE ELEVATION 624.2 ELEVATION DATUM NGVD  
 OBSERVATIONS \_\_\_\_\_  
 GROUND WATER Water enters borehole at 7.3'

SHEET 3 of 3  
 PROJECT NO. 91C7343  
 TASK NO. 0220  
 DATE 10/17/92  
 RIG CME-75

DEPTH, ft.	SAMPLE				DESCRIPTION	SYMBOL	ELEVATION	FIELD NOTES
	TYPE	RECOVERY	RESISTANCE	PP, KSF				
50					CLAYEY, SILTY SAND (SC-SM), very dense, dark gray, very fine to fine grained, poorly graded, with little to some clay and silt in fines, with trace of mica, with trace of disseminated carbonaceous (?) matter			
55							570	B.O.B. @ 53.0 ft.  Boring completed as monitoring well  Note: Resistance = 0 defines penetration w/out strokes of hammer
60							565	
65							560	
70							555	
75							550	



Woodward-Clyde Consultants

Figure No. A-



# BORING LOG

**MW-16**

PROJECT NAME Sheller-Globe (3200 Main Street)  
 PROJECT LOCATION Keokuk, Iowa  
 LOGGED BY G. Papinako DRILLED BY T. Clay (HTL)  
 SURFACE ELEVATION 625.1 ELEVATION DATUM NGVD  
 OBSERVATIONS \_\_\_\_\_  
 GROUND WATER Water enters borehole at 10.0'

SHEET 1 of 2  
 PROJECT NO. 91C7343  
 TASK NO. 0220  
 DATE 10/15/92  
 RIG CME-75

DEPTH, ft.	SAMPLE				SYMBOL	ELEVATION	FIELD NOTES
	TYPE	RECOVERY	RESISTANCE	PP, KSF			
0						625	Boring advanced w/ 4 1/4-inch I.D. HSA, 2-inch dia. split spoons, and 150 lbs automatic hammer HNU = BG
	S	1	1				HNU = BG
		2					
5	S	1	2			620	HNU = BG
		3					
	S	2	2				(Till)
		2					
10	S	2	3			615	Water enters ATD (10") HNU = BG
		3					
	S	1	2				HNU = BG
		2					
15	S	2	4			610	HNU = BG
		6					
	S	4	7				HNU = BG
		10					
20	S	4	6			605	HNU = BG
		9					
	S	6	7				HNU = BG
		10					
25							



# BORING LOG

MW-16

PROJECT NAME Sheller-Globe (3200 Main Street)  
 PROJECT LOCATION Keokuk, Iowa  
 LOGGED BY G. Papinako DRILLED BY T. Clay (HTL)  
 SURFACE ELEVATION 625.1 ELEVATION DATUM NGVD  
 OBSERVATIONS \_\_\_\_\_  
 GROUND WATER Water enters borehole at 10.0'

SHEET 2 of 2  
 PROJECT NO. 91C7343  
 TASK NO. 0220  
 DATE 10/15/92  
 RIG CME-75

DEPTH, ft.	SAMPLE			DESCRIPTION	SYMBOL	ELEVATION	FIELD NOTES
	TYPE	RECOVERY	RESISTANCE				
25	S		7 10 15	LEAN CLAY WITH SAND (CL), firm to hard, light yellowish-brown, with little fine grained sand, with iron oxides nodules, with seams and partings of calcareous matter		600	
	S		7 12 20	CLAYEY SAND (SC), dense, reddish-brown, fine grained, poorly graded, iron oxides (?) stained, with little to some clay as matrix			
30	S		7 18 24	LEAN CLAY WITH SAND AND GRAVEL (CL), hard, light gray, with trace of silt, with little fine grained sand, with little fine gravel		595	
	S		6 8 15	Becoming yellowish-brown, with abundant iron oxides (?) nodules Becoming light gray, with thin beds (0.1 inch) of fine grained, gray sand Becoming dark olive gray with white mottling, with seams of fine grained sand, with vertical fractures infilled with calcareous matter			
35						590	B.O.B. @ 36.0 ft.  Boring completed as monitoring well
40						585	
45						580	
50							





# BORING LOG

**MW-17A**

PROJECT NAME Sheller-Globe (3200 Main Street)  
 PROJECT LOCATION Keokuk, Iowa  
 LOGGED BY G. Papinako DRILLED BY T. Clay (HTL)  
 SURFACE ELEVATION 620.7 ELEVATION DATUM NGVD  
 OBSERVATIONS \_\_\_\_\_  
 GROUND WATER Water enters borehole at 8.0'

SHEET 1 of 1  
 PROJECT NO. 91C7343  
 TASK NO. 0220  
 DATE 10/14/92  
 RIG CME-75

DEPTH, ft.	SAMPLE			DESCRIPTION	SYMBOL	ELEVATION	FIELD NOTES
	TYPE	RECOVERY	RESISTANCE PP, KSF				
0				POORLY GRADED GRAVEL WITH CLAY (GP-GC), dense, light gray, coarse limestone gravel with little to some clay (Fill)		620	Boring advanced w/ 4 1/4-inch I.D. HSA, 2-inch dia. split spoons, and 150 lbs automatic hammer  HNU: Sample 1.0 ppm BZ= 0.2 ppm
	S		3 3 5	LEAN CLAY WITH SAND (CL), firm, light yellowish-brown with gray mottling, with iron oxides (?) nodules, with little fine grained sand (Fill)			
5	S		2 2 2	Becoming soft  Becoming dark olive with gray mottling		615	
	S		1 1 2	Becoming firm, light yellowish-brown			Water enters ATD (8.0') Sample 0.2 ppm (HNU) BZ= 0.2 (Alluvium)
10				SILT (ML), very soft, gray, low plastic, with abundant roots and root hairs, with small nodules of black carbonaceous (?) matter		610	
							B.O.B. @ 11.0 ft.
							Boring completed as monitoring well
15						605	
20						600	
25							



**Woodward-Clyde Consultants**

Figure No. A-



# BORING LOG

**MW-17B**

PROJECT NAME Sheller-Globe (3200 Main Street)  
 PROJECT LOCATION Keokuk, Iowa  
 LOGGED BY G. Papinako DRILLED BY T. Clay (HTL)  
 SURFACE ELEVATION 620.9 ELEVATION DATUM NGVD  
 OBSERVATIONS \_\_\_\_\_  
 GROUND WATER Water enters borehole at 9.0'

SHEET 1 of 2  
 PROJECT NO. 91C7343  
 TASK NO. 0220  
 DATE 10/13/92  
 RIG CME-75

DEPTH, ft.	SAMPLE				DESCRIPTION	SYMBOL	ELEVATION	FIELD NOTES
	TYPE	RECOVERY	RESISTANCE	PP, KSF				
0					POORLY GRADED GRAVEL WITH CLAY (GC), dense, gray, angular, limestone gravel, with some lean, grayish-brown clay (Fill)		620	Boring advanced w/ 4.5 inch I.D. HSA, 2-inch dia. split spoon and 150 lbs automatic hammer
	S		1 2 2		LEAN CLAY WITH GRAVEL (CL), soft to firm, light brown, with trace of fine well rounded gravel (Fill)			
5	S		2 3 2		Becoming soft, olive brown		615	WC > PL HNU=BZ=BG
	S		2 2 2		Becoming dark gray with pieces of wood Becoming firm, light brown, moist			
10	S		2 3 3		Becoming dark gray with olive mottling, with abundant root hairs			Water enters ATD (9.0')
	S		1 2 2		LEAN CLAY WITH SAND (CL), soft to firm, light gray with dark brown mottling, with trace of fine grained sand, with abundant iron oxides (?), with vertical sparse fractures		610	(Till) HNU=BG
					Becoming bluish-gray with roots and root hairs Becoming light gray			
15	S		2 4 5		Quantity of sand increasing		605	
	S		4 5 10		CLAYEY SAND (SC), loose, grayish-brown, poorly graded, with some lean clay as matrix			
20	S		3 5 5		LEAN CLAY WITH SAND AND GRAVEL (CL), firm to hard, light yellowish-brown, with little fine grained sand, with little fine well rounded gravel, with iron oxides (?) nodules, with small lenses of carbonaceous (?) matter, with vertical fractures infilled with calcareous matter		600	HNU=BG
	S		5 22 37		Becoming very hard, with seams and partings of calcareous matter Quantity of gravel decreasing			
25								



# BORING LOG

MW-17B

PROJECT NAME Sheller-Globe (3200 Main Street)  
 PROJECT LOCATION Keokuk, Iowa  
 LOGGED BY G. Papinako DRILLED BY T. Clay (HTL)  
 SURFACE ELEVATION 620.9 ELEVATION DATUM NGVD  
 OBSERVATIONS \_\_\_\_\_  
 GROUND WATER Water enters borehole at 9.0'

SHEET 2 of 2  
 PROJECT NO. 91C7343  
 TASK NO. 0220  
 DATE 10/13/92  
 RIG CME-75

DEPTH, ft.	SAMPLE				DESCRIPTION	SYMBOL	ELEVATION	FIELD NOTES
	TYPE	RECOVERY	RESISTANCE	PP, KSF				
25	S		12		LEAN CLAY WITH SAND (CL), hard, light yellowish-brown, with dark gray mottling, with iron oxides (?) nodules, with little fine grained sand, with trace of fine gravel		595	HNU = BG
			19					
			26					
30	S				CLAYEY SAND WITH GRAVEL (SC), very dense, dark olive gray with white mottling, poorly graded, with lean clay in matrix and in small beds, with little fine gravel, with zones of weak calcareous cementation			HNU = BG
35			17		LEAN CLAY WITH SAND (CL), very hard, light brown with gray mottling, with seams and partings of fine grained sand		590	HNU = BG
			22		Becoming dark gray			
			32		With layer of dark gray, clayey, fine grained sand (0.5 feet thick)			
35							585	B.O.B. @ 35.0 ft.
								Boring completed as monitoring well
40							580	
45							575	
50								



Woodward-Clyde Consultants

Figure No. A-



# BORING LOG

MW-18

PROJECT NAME Sheller-Globe (3200 Main Street)  
 PROJECT LOCATION Keokuk, Iowa  
 LOGGED BY G. Papinako DRILLED BY T. Clay (HTL)  
 SURFACE ELEVATION 623.8 ELEVATION DATUM NGVD  
 OBSERVATIONS \_\_\_\_\_  
 GROUND WATER Water enters borehole at 22.5'

SHEET 1 of 2  
 PROJECT NO. 91C7343  
 TASK NO. 0220  
 DATE 10/15/92  
 RIG CME-75

DEPTH, ft.	SAMPLE			DESCRIPTION	SYMBOL	ELEVATION	FIELD NOTES
	TYPE	RECOVERY	RESISTANCE				
0				ASPHALT AND POORLY GRADED GRAVEL WITH CLAY (GC)			Boring advanced w/ 4-inch I.D. HSA, 2-inch dia. split spoons, and 150 lbs automatic hammer HNU = BG
				LEAN CLAY WITH SAND (CL), firm, light brown (Fill)			
				Becoming dark olive brown with light gray mottling			
	S		2	With trace of fine grained sand		620	HNU Sample 1.2 ppm BZ = BG
			2	With abundant roots and root hairs			
			2	With pieces of wood			
5	S		2				HNU Sample 1.2 ppm BZ = BG
			4				
			4				
	S		2	LEAN CLAY WITH SAND (CL), firm, light brown with little coarse grained sand		615	HNU Sample 1.2 ppm BZ = BG (Till)
			4				
			7				
10	S		5	With calcareous seams and partings			HNU Sample 2.2 ppm BZ = BG
			7	With vertical fractures and root channels infilled with gray calcareous matter			
			7	With manganese oxides (?) mottling			
	S		5				HNU Sample 3.2 ppm BZ = BG
			8				
			10	Quantity of sand increasing		610	
15	S		8	With manganese oxides (?) staining			HNU Sample 1.0-1.5 ppm BZ = BG
			8	With zones of strong calcareous cementation			
			9				
	S		7				HNU Sample 4-5 ppm BZ = BG
			8			605	
			9				
20	S		6	With extensive (1 foot long) vertical fractures infilled with clayey calcareous matter			HNU Sample 0.4 to 4.0 ppm BZ = BG
			9				
			10				
	S		13	With trace of coarse gravel			Water enters ATD (22.5') Zero recovery due to coarse gravel encountered
			11			600	
			10				
25							



# BORING LOG

MW-18

PROJECT NAME Sheller-Globe (3200 Main Street)  
 PROJECT LOCATION Keokuk, Iowa  
 LOGGED BY G. Papinako DRILLED BY T. Clay (HTL)  
 SURFACE ELEVATION 623.8 ELEVATION DATUM NGVD  
 OBSERVATIONS \_\_\_\_\_  
 GROUND WATER Water enters borehole at 22.5'

SHEET 2 of 2  
 PROJECT NO. 91C7343  
 TASK NO. 0220  
 DATE 10/15/92  
 RIG CME-75

DEPTH, ft.	SAMPLE				DESCRIPTION	SYMBOL	ELEVATION	FIELD NOTES
	TYPE	RECOVERY	RESISTANCE	PP, KSF				
25	S		5 12 40		LEAN CLAY WITH SAND (CL), firm grayish-brown, with large lenses of calcareous powdery matter			Drilling resumed 10-16-92
					CLAYEY SAND (SC), very dense, bright reddish-yellow, fine grained, poorly graded, stained with iron oxides (?), with clay in matrix			Sample HNU = BG
	S		5 27 32		With layer of fat clay, soft, dark olive gray (2.5 inch thick)		595	Sample HNU = BG
30	S		6 12 17		LEAN CLAY WITH SAND (CL), soft to firm, light brown to yellowish brown, with little to some coarse and fine grained sand, with iron oxides (?) staining			Sample HNU = BG
					Becoming gray with trace of coarse gravel			
	S		7 12 17		Becoming light brown, with little coarse, angular gravel. Maximum size 1.2 inch. with iron oxides (?) staining		590	Sample HNU = BG
35								
								B.O.B. @ 36.0 ft.
								Boring completed as monitoring well
40							585	
							580	
45								
							575	
50								



**APPENDIX B**  
**MONITORING WELL INSTALLATION REPORTS**

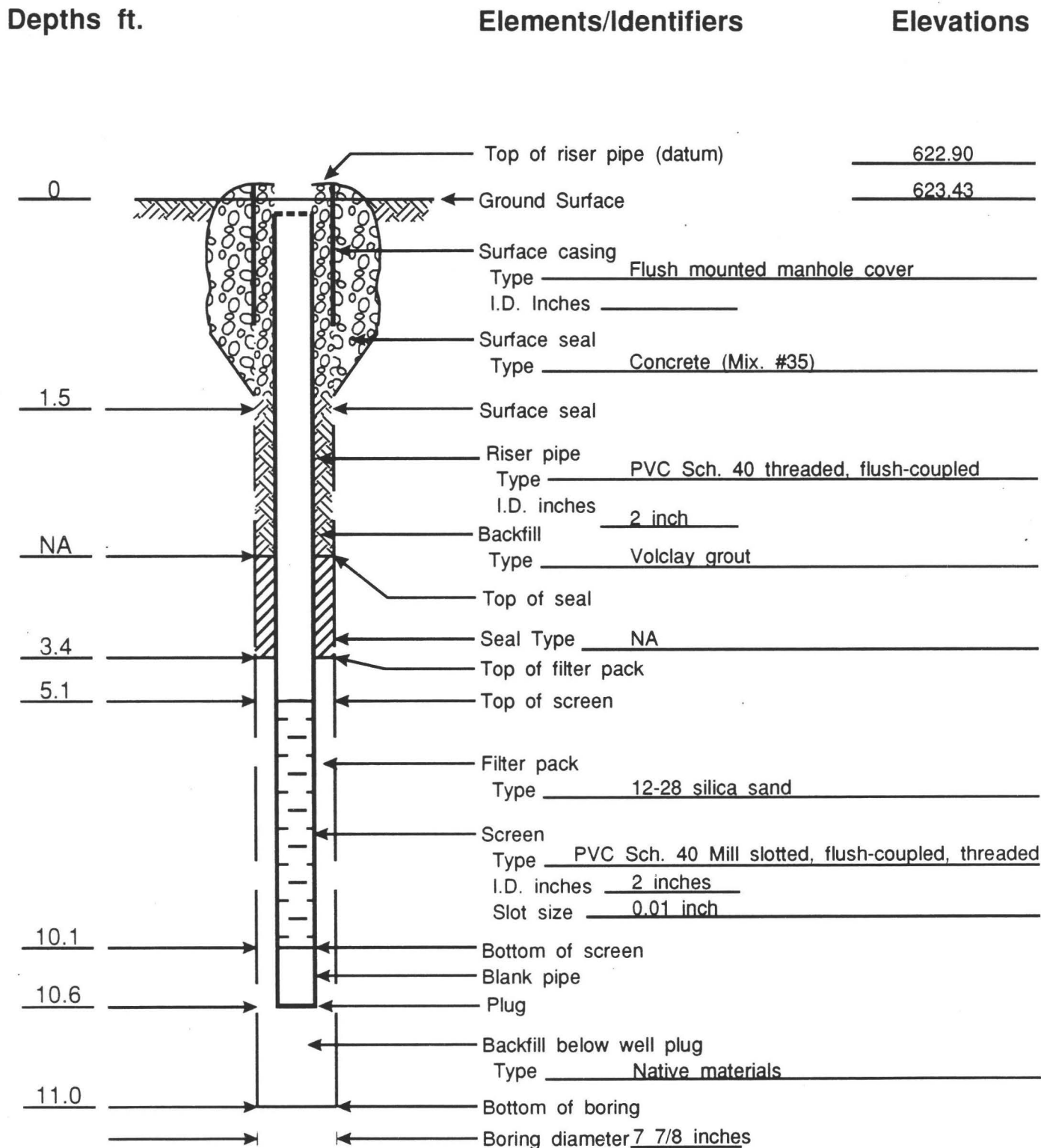
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# GROUNDWATER MONITORING WELL REPORT

Project Name Sheller-Globe (3200 Main Street)  
 Location Keokuk, Iowa  
 Installed by Hannibal Testing Labs, Inc.  
 Inspected by G. Papinako, Woodward-Clyde Consultants  
 Method of Installation Filter pack, Volclay grout placed through the string of HSA  
 Remarks Tremie pipe with deflector used for grout placement

Well No. MW-13A  
 Project No. 91C7343  
 Date 10/18/92  
 Time 12:20  
 Boring No. \_\_\_\_\_

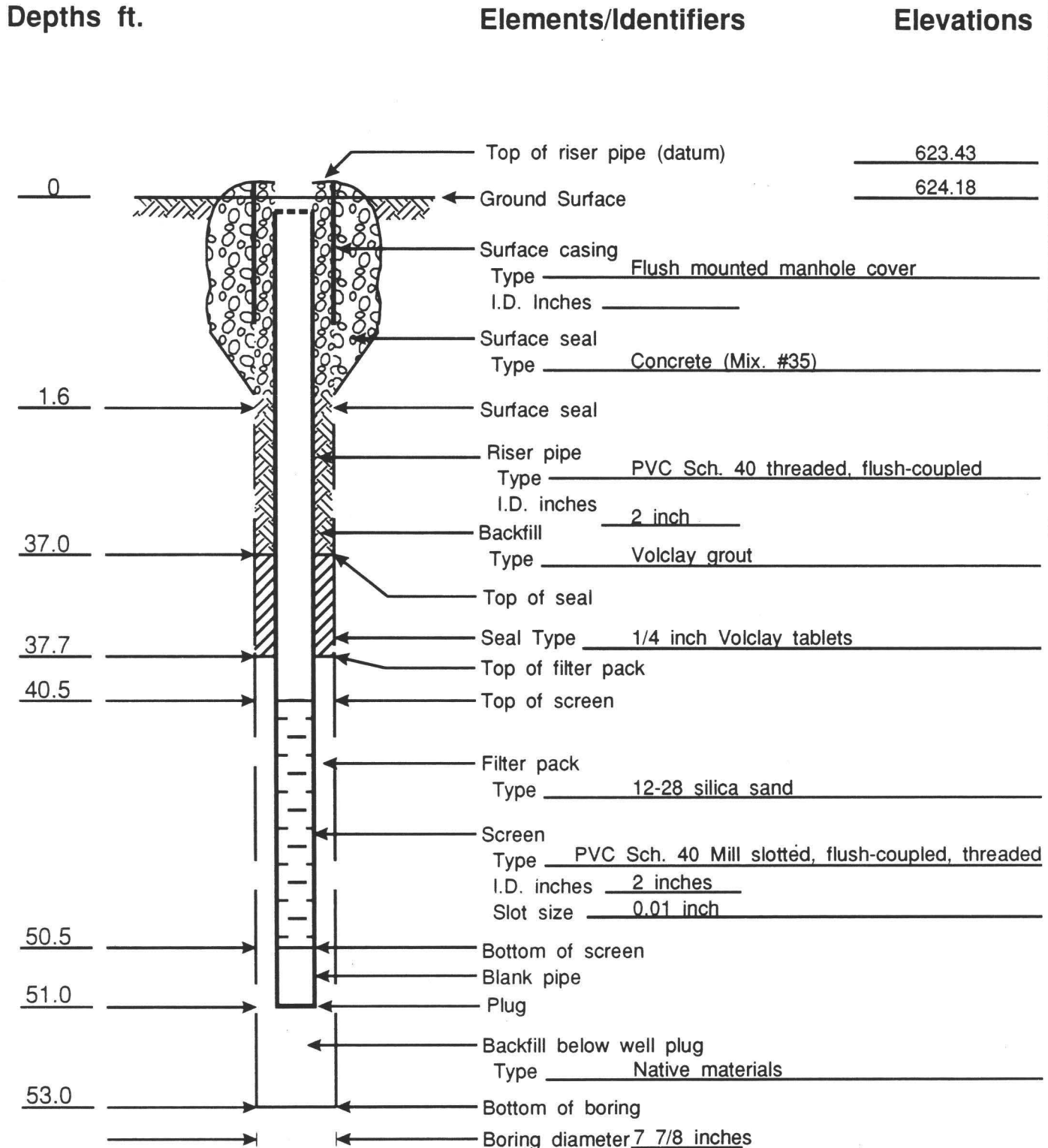




# GROUNDWATER MONITORING WELL REPORT

Project Name Sheller-Globe (3200 Main Street)  
 Location Keokuk, Iowa  
 Installed by Hannibal Testing Labs, Inc.  
 Inspected by G. Papinako, Woodward-Clyde Consultants  
 Method of Installation Filter pack, Volclay grout placed through the string of HSA  
 Remarks Tremie pipe with deflector used for grout placement

Well No. MW-13B  
 Project No. 91C7343  
 Date 10/17/92  
 Time 15:50  
 Boring No. \_\_\_\_\_

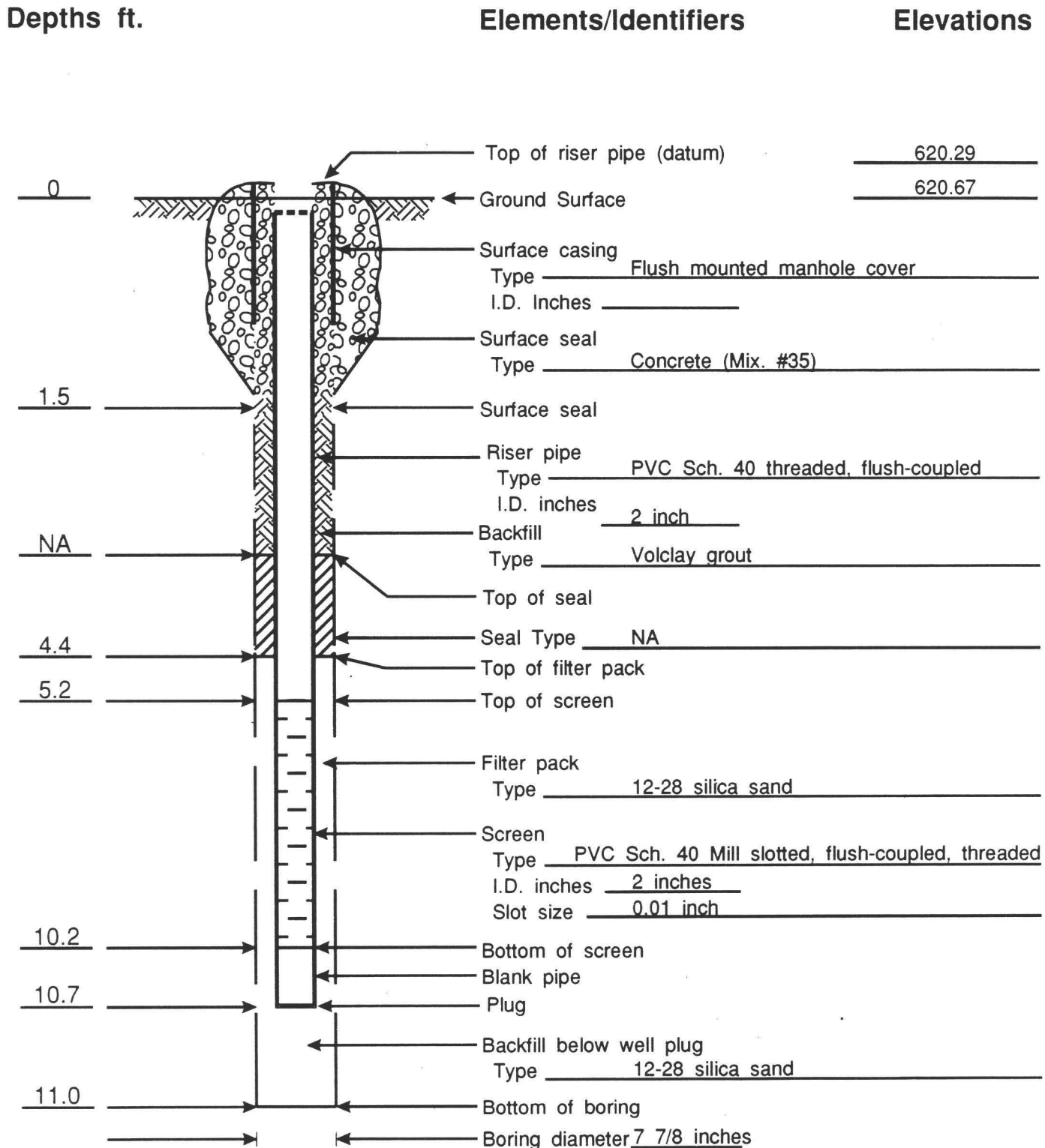




# GROUNDWATER MONITORING WELL REPORT

Project Name Sheller-Globe (3200 Main Street)  
 Location Keokuk, Iowa  
 Installed by Hannibal Testing Labs, Inc.  
 Inspected by G. Papinako, Woodward-Clyde Consultants  
 Method of Installation Filter pack, Volclay grout placed through the string of HSA  
 Remarks \_\_\_\_\_

Well No. MW-17A  
 Project No. 91C7343  
 Date 10/14/92  
 Time 14:15  
 Boring No. \_\_\_\_\_



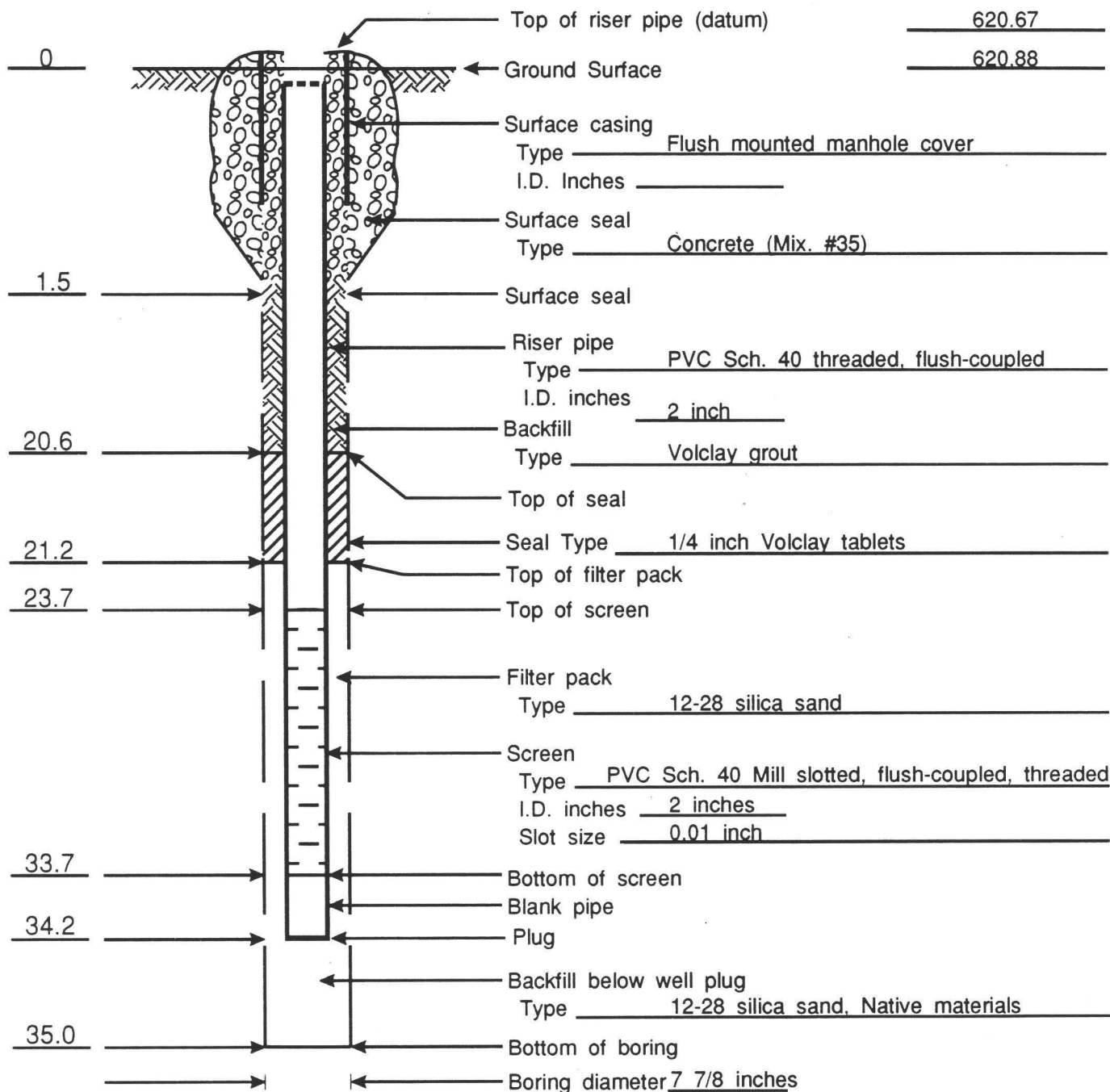


# GROUNDWATER MONITORING WELL REPORT

Project Name Sheller-Globe (3200 Main Street)  
 Location Keokuk, Iowa  
 Installed by Hannibal Testing Labs, Inc.  
 Inspected by G. Papinako, Woodward-Clyde Consultants  
 Method of Installation Filter pack, Volclay grout placed through the string of HSA  
 Remarks Tremie pipe with deflector used for grout placement

Well No. MW-17B  
 Project No. 91C7343  
 Date 10/14/92  
 Time 09:30  
 Boring No. \_\_\_\_\_

Depths ft.	Elements/Identifiers	Elevations
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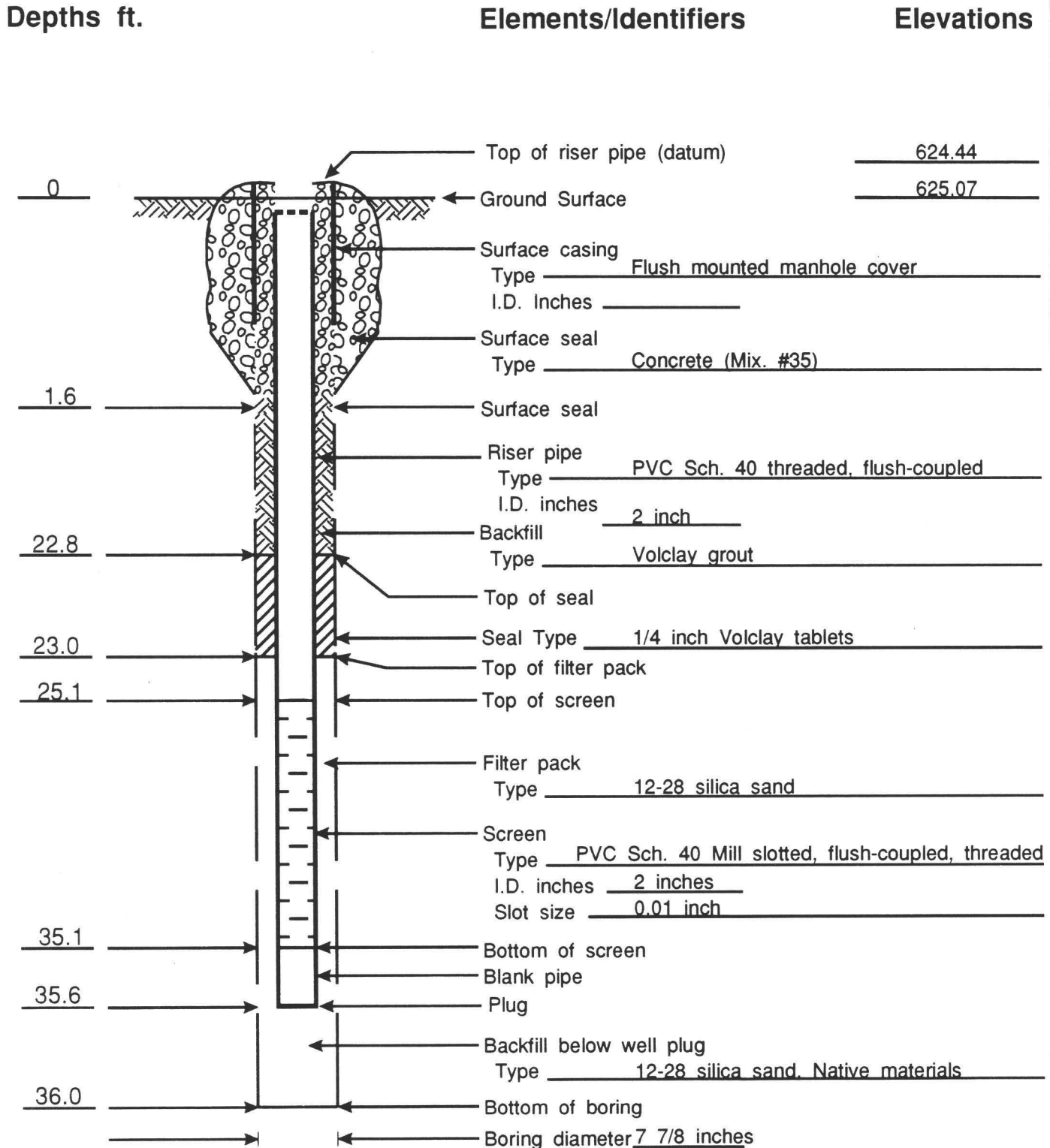




# GROUNDWATER MONITORING WELL REPORT

Project Name Sheller-Globe (3200 Main Street)  
 Location Keokuk, Iowa  
 Installed by Hannibal Testing Labs, Inc.  
 Inspected by G. Papinako, Woodward-Clyde Consultants  
 Method of Installation Filter pack, seal and Volclay grout placed through the string of HSA  
 Remarks Tremie pipe with deflector used for grout placement

Well No. MW-16  
 Project No. 91C7343  
 Date 10/16/92  
 Time 11:10  
 Boring No. \_\_\_\_\_

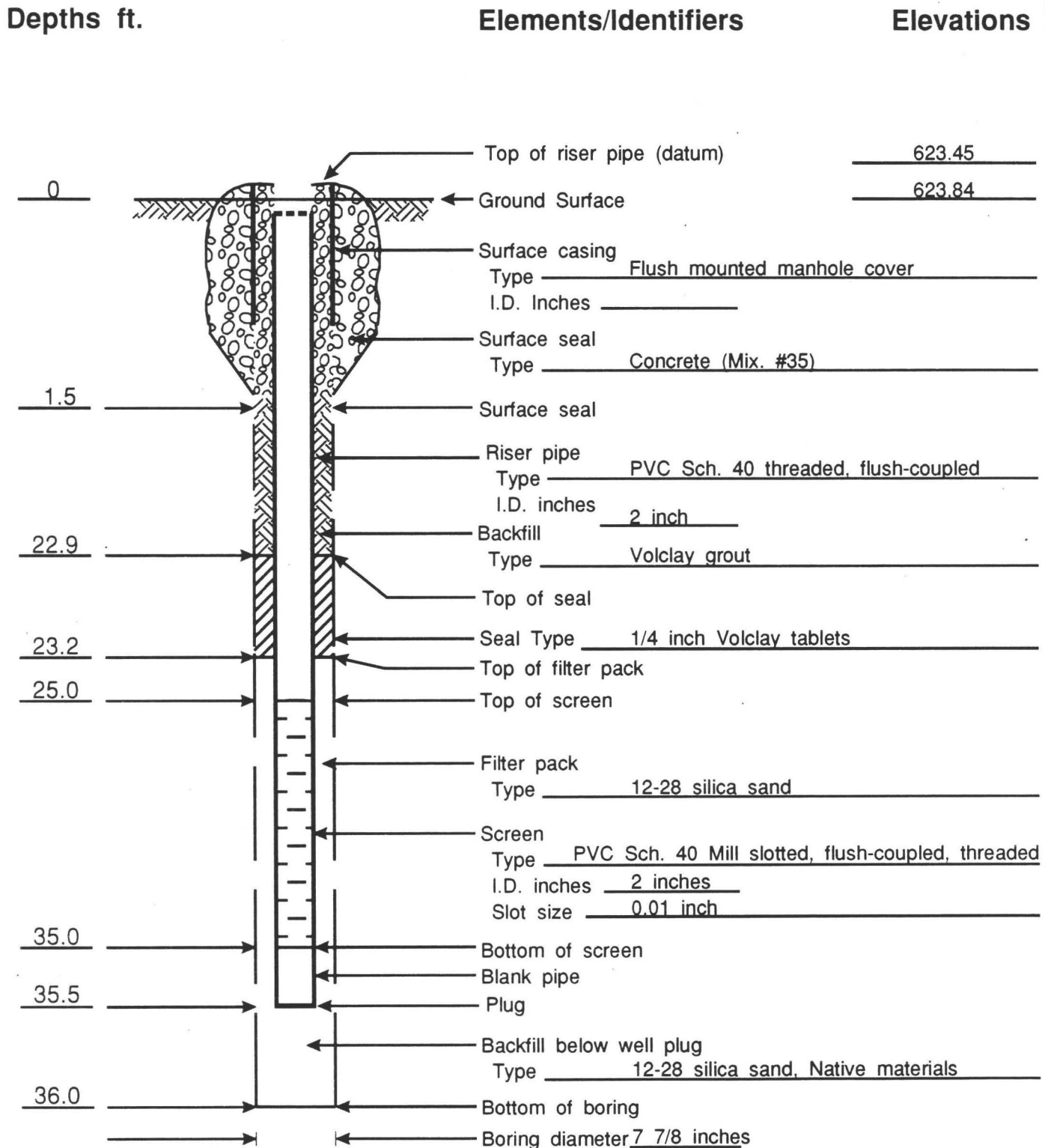




# GROUNDWATER MONITORING WELL REPORT

Project Name Sheller-Globe (3200 Main Street)  
 Location Keokuk, Iowa  
 Installed by Hannibal Testing Labs, Inc.  
 Inspected by G. Papinako, Woodward-Clyde Consultants  
 Method of Installation Filter pack, Bentonite seal, Volclay grout  
placed through the string of HSA  
 Remarks Tremie pipe with deflector used for grout placement

Well No. MW-18  
 Project No. 91C7343  
 Date 10/15/92  
 Time 13:20  
 Boring No. \_\_\_\_\_





**APPENDIX C**  
**SAMPLE COLLECTION FIELD SHEETS**

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## WOODWARD-CLYDE CONSULTANTS

5055 Antioch Road  
Overland Park, Kansas 66203  
(913) 432-4242

## SAMPLE COLLECTION FIELD SHEET - WATER SAMPLES

PROJECT NAME: Facility at 3200 Main PROJECT NUMBER: 91C7343  
SAMPLE NUMBER: MW-10 PERSONNEL: D. Kocour,  
G. Papinako  
LOCATION DESCRIPTION Parking lot of the plant  
SAMPLE MEDIA (circle one): GROUNDWATER SURFACEWATER OTHER: \_\_\_\_\_  
SAMPLE SPLIT (circle one): YES NO : SPLIT SAMPLE NUMBER: MW-19 (blind duplicate)  
WATER LEVEL: 0.92 ft.  
WATER LEVEL MEASUREMENT FROM TOP OF RISER PIPE: 0.92 ft.  
COLLECTION: YR: 92 MO: 11 DAY: 02 TIME: 8:00 METHOD: Bailing

SAMPLE CONTAINER	PRESERVATIVE	ANALYSIS REQUESTED
<u>3-40ml glass vials</u>	<u>HCL</u>	<u>TCL Volatiles + MIBK,</u> <u>Hexane, and Butanol</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

## FIELD ANALYSIS

TEMPERATURE, °C 13 DATE 11/2/92  
SAMPLE pH 6.1 TIME 8:00  
SALINITY, PARTS PER THOU 0 APPEARANCE Clear  
CONDUCTIVITY, umhos/cm 1000 ODOR \_\_\_\_\_  
pH BUFFER BEFORE 7.0 - 4.0 pH BUFFER AFTER 7.0 - 4.1  
COMMENTS \_\_\_\_\_

## DEVELOPMENT/PURGING

DATE 11/1/92 CASING DIAMETER 4 in.  
WATER LEVEL BEFORE 0.92 ft. 1.24 ft. WELL DEPTH (SOUNDED) 29.65 ft.  
WATER LEVEL AFTER Bailed dry TIME STARTED 16:00  
EST. VOLUME REMOVED 35 gals TIME COMPLETED 16:50  
HNU/OVA, BACKGROUND 0.4 ppm METHOD Bailing  
HNU/OVA, WELL HEAD 7.0 ppm HNU/OVA, BREATHING ZONE 0.4 ppm  
COMMENTS \_\_\_\_\_





## WOODWARD-CLYDE CONSULTANTS

5055 Antioch Road  
Overland Park, Kansas 66203  
(913) 432-4242

## SAMPLE COLLECTION FIELD SHEET - WATER SAMPLES

PROJECT NAME: Facility at 3200 Main PROJECT NUMBER: 9167343  
SAMPLE NUMBER: MW-11 PERSONNEL: D. Kocour, G. Papeneko  
LOCATION DESCRIPTION: Parking lot  
SAMPLE MEDIA (circle one): GROUNDWATER SURFACEWATER OTHER: \_\_\_\_\_  
SAMPLE SPLIT (circle one): YES NO : SPLIT SAMPLE NUMBER: \_\_\_\_\_  
WATER LEVEL: \_\_\_\_\_  
WATER LEVEL MEASUREMENT FROM TOP OF RISER PIPE: 5.55 ft.  
COLLECTION: YR: 92 MO: 11 DAY: 2 TIME: 0815 METHOD: Bailing

SAMPLE CONTAINER	PRESERVATIVE	ANALYSIS REQUESTED
<u>3-40ml glass vials</u>	<u>HCL</u>	<u>TLL Volatiles + MIBK, Hexane, and Butanol</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

## FIELD ANALYSIS

TEMPERATURE, °C 17.0 DATE 11/2/92  
SAMPLE pH 6.4 TIME 8:15  
SALINITY, PARTS PER THOU 0 APPEARANCE Clear  
CONDUCTIVITY, umhos/cm 900 ODOR None  
pH BUFFER BEFORE 7.0 - 4.0 pH BUFFER AFTER 7.1 - 4.0  
COMMENTS \_\_\_\_\_

## DEVELOPMENT/PURGING

DATE 11/1/92 CASING DIAMETER 2 in.  
WATER LEVEL BEFORE 6.00 ft. WELL DEPTH (SOUNDED) 34.40 ft.  
WATER LEVEL AFTER 8.23 ft TIME STARTED 17:30  
EST. VOLUME REMOVED 15 gals TIME COMPLETED 18:10  
HNU/OVA, BACKGROUND 0.4 ppm METHOD Bailing  
HNU/OVA, WELL HEAD BG HNU/OVA, BREATHING ZONE 0.4 ppm  
COMMENTS \_\_\_\_\_





## WOODWARD-CLYDE CONSULTANTS

5055 Antioch Road  
Overland Park, Kansas 66203  
(913) 432-4242

## SAMPLE COLLECTION FIELD SHEET - WATER SAMPLES

PROJECT NAME: Scheller-Globe (3200 Main) PROJECT NUMBER: 91C7343  
SAMPLE NUMBER: NW-13 PERSONNEL: D. Kocour  
G. Papinako  
LOCATION DESCRIPTION Parking lot of the facility  
SAMPLE MEDIA (circle one): GROUNDWATER SURFACEWATER OTHER: \_\_\_\_\_  
SAMPLE SPLIT (circle one): YES (NO) : SPLIT SAMPLE NUMBER: \_\_\_\_\_  
WATER LEVEL: \_\_\_\_\_  
WATER LEVEL MEASUREMENT FROM TOP OF RISER PIPE: 2.55 ft  
COLLECTION: YR: 92 MO: 11 DAY: 2 TIME: 1030 METHOD: Bailing

SAMPLE CONTAINER	PRESERVATIVE	ANALYSIS REQUESTED
<u>3-40ml glass vials</u>	<u>HCL</u>	<u>TCL Volatiles + MIBK,</u> <u>Hexane, Butanol</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

## FIELD ANALYSIS

TEMPERATURE, °C 15.0 DATE 11/2/92  
SAMPLE pH 5.9 TIME 1030  
SALINITY, PARTS PER THOU 0.5 APPEARANCE \_\_\_\_\_  
CONDUCTIVITY, umhos/cm 1150 ODOR \_\_\_\_\_  
pH BUFFER BEFORE 4.0 - 7.0 pH BUFFER AFTER 4.0 - 6.9  
COMMENTS \_\_\_\_\_

## DEVELOPMENT/PURGING

DATE 11/1/92 11/2/92 CASING DIAMETER 2 inch  
WATER LEVEL BEFORE 2.64 WELL DEPTH (SOUNDED) 27.91 ft.  
WATER LEVEL AFTER 2.55 TIME STARTED 7:10  
EST. VOLUME REMOVED 15 gals. TIME COMPLETED 7:45  
HNU/OVA, BACKGROUND 0.4 ppm METHOD Bailing  
HNU/OVA, WELL HEAD 40 ppm HNU/OVA, BREATHING ZONE 0.4 ppm  
COMMENTS \_\_\_\_\_





## WOODWARD-CLYDE CONSULTANTS

5055 Antioch Road  
Overland Park, Kansas 66203  
(913) 432-4242

## SAMPLE COLLECTION FIELD SHEET - WATER SAMPLES

PROJECT NAME: Scheller-Globe (3200 Main) PROJECT NUMBER: 91C7343SAMPLE NUMBER: MW-13A PERSONNEL: D. Kocour.  
G. PapinakoLOCATION DESCRIPTION Facility parking lotSAMPLE MEDIA (circle one): GROUNDWATER SURFACEWATER OTHER: \_\_\_\_\_SAMPLE SPLIT (circle one): YES NO: SPLIT SAMPLE NUMBER: \_\_\_\_\_

WATER LEVEL: \_\_\_\_\_

WATER LEVEL MEASUREMENT FROM TOP OF RISER PIPE: 6.58 ft.COLLECTION: YR: 92 MO: 11 DAY: 2 TIME: 1130 METHOD: Bailing  
HOO

SAMPLE CONTAINER	PRESERVATIVE	ANALYSIS REQUESTED
<u>3 x 40 ml glass vials</u>	<u>HCl</u>	<u>TCL Volatiles + MIBK,</u> <u>Hexane, Butanol</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

## FIELD ANALYSIS

TEMPERATURE, °C 15.2DATE 92/11/2SAMPLE pH 5.5TIME 1130SALINITY, PARTS PER THOU 0.25APPEARANCE ClearCONDUCTIVITY, umhos/cm 1150ODOR NonepH BUFFER BEFORE 4.0 - 7.0pH BUFFER AFTER 4.0 - 7.0

COMMENTS \_\_\_\_\_

## DEVELOPMENT/PURGING

DATE 11-02-92CASING DIAMETER 2 inchWATER LEVEL BEFORE 2.42WELL DEPTH (SOUNDED) 10.29WATER LEVEL AFTER 6.58TIME STARTED 8:30EST. VOLUME REMOVED 5 galsTIME COMPLETED 8:50HNU/OVA, BACKGROUND 0.4 ppmMETHOD BailingHNU/OVA, WELL HEAD 2.2 ppmHNU/OVA, BREATHING ZONE 0.4 ppm

COMMENTS \_\_\_\_\_





## WOODWARD-CLYDE CONSULTANTS

5055 Antioch Road  
Overland Park, Kansas 66203  
(913) 432-4242

## SAMPLE COLLECTION FIELD SHEET - WATER SAMPLES

PROJECT NAME: Scheller - Globe (3200 Main) PROJECT NUMBER: 91C7343SAMPLE NUMBER: MW-13B PERSONNEL: D. Kocour,  
G. Papinako

LOCATION DESCRIPTION \_\_\_\_\_

SAMPLE MEDIA (circle one): GROUNDWATER SURFACEWATER OTHER: \_\_\_\_\_SAMPLE SPLIT (circle one): YES NO: SPLIT SAMPLE NUMBER: \_\_\_\_\_

WATER LEVEL: \_\_\_\_\_

WATER LEVEL MEASUREMENT FROM TOP OF RISER PIPE: 43.58COLLECTION: YR: 92 MO: 11 DAY: 2 TIME: 1100 METHOD: Bailing

SAMPLE CONTAINER	PRESERVATIVE	ANALYSIS REQUESTED
<u>40 ml glass vial (3)</u>	<u>HCl</u>	<u>TCL Volatiles + MIBK</u>
_____	_____	<u>Hexane, Butanol</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

## FIELD ANALYSIS

TEMPERATURE, °C 12.9 DATE 11/2/92SAMPLE pH 5.9 TIME 1100SALINITY, PARTS PER THOU 0 APPEARANCE ClearCONDUCTIVITY, umhos/cm 830 ODOR NonepH BUFFER BEFORE 4.0 - 7.0 pH BUFFER AFTER 4.1 - 6.9

COMMENTS \_\_\_\_\_

## DEVELOPMENT/PURGING

DATE 11-02-92 CASING DIAMETER 2 inchesWATER LEVEL BEFORE 7.29 WELL DEPTH (SOUNDED) 50.11WATER LEVEL AFTER 43.58 TIME STARTED 7:50EST. VOLUME REMOVED 13 gals (bailed dry) TIME COMPLETED 8:25HNU/OVA, BACKGROUND 0.4 ppm METHOD BailingHNU/OVA, WELL HEAD BC HNU/OVA, BREATHING ZONE BC

COMMENTS \_\_\_\_\_





## WOODWARD-CLYDE CONSULTANTS

5055 Antioch Road  
Overland Park, Kansas 66203  
(913) 432-4242

## SAMPLE COLLECTION FIELD SHEET - WATER SAMPLES

PROJECT NAME: Schaller - Globe (3200 Main St) PROJECT NUMBER: 91C7343SAMPLE NUMBER: MW-14 PERSONNEL: D. Kocour,  
G. PapinakoLOCATION DESCRIPTION Farm Parking lotSAMPLE MEDIA (circle one): GROUNDWATER SURFACEWATER OTHER: \_\_\_\_\_SAMPLE SPLIT (circle one): YES (NO): SPLIT SAMPLE NUMBER: \_\_\_\_\_

WATER LEVEL: \_\_\_\_\_

WATER LEVEL MEASUREMENT FROM TOP OF RISER PIPE: 10.07COLLECTION: YR: 92 MO: 11 DAY: 2 TIME: 0830 METHOD: \_\_\_\_\_

SAMPLE CONTAINER	PRESERVATIVE	ANALYSIS REQUESTED
<u>3-40ml glass vials</u>	<u>HCL</u>	<u>TCL Volatiles + MIBK</u> <u>Hexane + Butanol</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

## FIELD ANALYSIS

TEMPERATURE, °C 12.0DATE 11/2/92SAMPLE pH 6.0TIME 0830SALINITY, PARTS PER THOU 0APPEARANCE ClearCONDUCTIVITY, umhos/cm 1050

ODOR \_\_\_\_\_

pH BUFFER BEFORE 4.0-7.0pH BUFFER AFTER 4.1-6.9

COMMENTS \_\_\_\_\_

## DEVELOPMENT/PURGING

DATE 11/1/92CASING DIAMETER 2 in.WATER LEVEL BEFORE 9.40WELL DEPTH (SOUNDED) 32.46 ft.WATER LEVEL AFTER 10.35TIME STARTED 16:55EST. VOLUME REMOVED 15 galsTIME COMPLETED 17:25HNU/OVA, BACKGROUND 0.4 ppmMETHOD BailingHNU/OVA, WELL HEAD BGHNU/OVA, BREATHING ZONE BG

COMMENTS \_\_\_\_\_





## WOODWARD-CLYDE CONSULTANTS

5055 Antioch Road  
Overland Park, Kansas 66203  
(913) 432-4242

## SAMPLE COLLECTION FIELD SHEET - WATER SAMPLES

PROJECT NAME: Scheller - Globe (3200 Main St) PROJECT NUMBER: 91C7343SAMPLE NUMBER: MW-16 PERSONNEL: D. Kocour  
G. PapinakoLOCATION DESCRIPTION Parking lotSAMPLE MEDIA (circle one): GROUNDWATER SURFACEWATER OTHER: \_\_\_\_\_SAMPLE SPLIT (circle one): YES NO : SPLIT SAMPLE NUMBER: \_\_\_\_\_

WATER LEVEL: \_\_\_\_\_

WATER LEVEL MEASUREMENT FROM TOP OF RISER PIPE: 4.98 ft.COLLECTION: YR: 92 MO: 11 DAY: 02 TIME: 0900 METHOD: Bailing

SAMPLE CONTAINER	PRESERVATIVE	ANALYSIS REQUESTED
<u>40 ml glass vial (3)</u>	<u>HCl</u>	<u>TCL Volatiles, + MPAK</u> <u>Hexane + Butanol</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

## FIELD ANALYSIS

TEMPERATURE, °C 12.0DATE 11-02-92SAMPLE pH 5.6TIME 0900SALINITY, PARTS PER THOU 0

APPEARANCE \_\_\_\_\_

CONDUCTIVITY, umhos/cm 550

ODOR \_\_\_\_\_

pH BUFFER BEFORE 4.0 - 7.0pH BUFFER AFTER 4.0 - 7.0

COMMENTS \_\_\_\_\_

## DEVELOPMENT/PURGING

DATE 11-01-92CASING DIAMETER 2 inchWATER LEVEL BEFORE 9.40WELL DEPTH (SOUNDED) 32.46WATER LEVEL AFTER 9.50TIME STARTED 17:25EST. VOLUME REMOVED +2 gals 15 galsTIME COMPLETED 17:50HNU/OVA, BACKGROUND 0.4 ppmMETHOD BailingHNU/OVA, WELL HEAD BGHNU/OVA, BREATHING ZONE 86

COMMENTS \_\_\_\_\_





## WOODWARD-CLYDE CONSULTANTS

5055 Antioch Road  
Overland Park, Kansas 66203  
(913) 432-4242

## SAMPLE COLLECTION FIELD SHEET - WATER SAMPLES

PROJECT NAME: Scheller-Globe PROJECT NUMBER: 91C7373  
SAMPLE NUMBER: MW-17A PERSONNEL: D. Kocour  
G. Papinako  
LOCATION DESCRIPTION: Area adjacent to the Cooling Pond  
SAMPLE MEDIA (circle one): GROUNDWATER SURFACEWATER OTHER: \_\_\_\_\_  
SAMPLE SPLIT (circle one): YES NO: SPLIT SAMPLE NUMBER: \_\_\_\_\_  
WATER LEVEL: \_\_\_\_\_  
WATER LEVEL MEASUREMENT FROM TOP OF RISER PIPE: 3.25 ft.  
COLLECTION: YR: 92 MO: 11 DAY: 2 TIME: 1015 ~~1000~~ METHOD: \_\_\_\_\_

SAMPLE CONTAINER	PRESERVATIVE	ANALYSIS REQUESTED
<u>40 ml glass vial (3)</u>	<u>HCl</u>	<u>TCL Volatiles, MIBK, Hexane, Butanol</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

## FIELD ANALYSIS

TEMPERATURE, °C 13.0 DATE 11/2/92  
SAMPLE pH 6.0 TIME 1000-1015  
SALINITY, PARTS PER THOU 0.5 APPEARANCE Clear  
CONDUCTIVITY, umhos/cm 1500 ODOR \_\_\_\_\_  
pH BUFFER BEFORE \_\_\_\_\_ pH BUFFER AFTER \_\_\_\_\_  
COMMENTS \_\_\_\_\_

## DEVELOPMENT/PURGING

DATE 11/1/92 CASING DIAMETER 2 inches  
WATER LEVEL BEFORE 3.55 WELL DEPTH (SOUNDED) 10.63 ft.  
WATER LEVEL AFTER Bailed dry TIME STARTED 16:40  
EST. VOLUME REMOVED 5 gals TIME COMPLETED 17:20  
HNU/OVA, BACKGROUND 0.2 ppm METHOD Bailing  
HNU/OVA, WELL HEAD 0.6 HNU/OVA, BREATHING ZONE B6  
COMMENTS \_\_\_\_\_





# WOODWARD-CLYDE CONSULTANTS

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(913) 432-4242

## SAMPLE COLLECTION FIELD SHEET - WATER SAMPLES

PROJECT NAME: Schiller-Globe PROJECT NUMBER: 91C 7343  
SAMPLE NUMBER: NW-17B PERSONNEL: D. Kocour,  
G. Papinaho  
LOCATION DESCRIPTION \_\_\_\_\_  
SAMPLE MEDIA (circle one): GROUNDWATER SURFACEWATER OTHER: \_\_\_\_\_  
SAMPLE SPLIT (circle one): YES NO: SPLIT SAMPLE NUMBER: \_\_\_\_\_  
WATER LEVEL: Top of casing  
WATER LEVEL MEASUREMENT FROM TOP OF RISER PIPE: 0 ft  
COLLECTION: YR: 92 MO: 11 DAY: 2 TIME: 1000 METHOD: Bailing

SAMPLE CONTAINER	PRESERVATIVE	ANALYSIS REQUESTED
<u>3-40ml glass vials</u>	<u>HCl</u>	<u>TCH Volatiles + MIRK,</u> <u>Hexane, Butanol</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

### FIELD ANALYSIS

TEMPERATURE, °C 11.0 DATE 11/2/92  
SAMPLE pH 6.4 TIME 1000  
SALINITY, PARTS PER THOU 0 APPEARANCE slightly cloudy  
CONDUCTIVITY, umhos/cm 800 ODOR \_\_\_\_\_  
pH BUFFER BEFORE \_\_\_\_\_ pH BUFFER AFTER \_\_\_\_\_  
COMMENTS \_\_\_\_\_

### DEVELOPMENT/PURGING

DATE 11/1/92 CASING DIAMETER 2 in.  
WATER LEVEL BEFORE Top of casing WELL DEPTH (SOUNDED) 33.61 ft.  
WATER LEVEL AFTER 2.72 TIME STARTED 16:00  
EST. VOLUME REMOVED 20 gals TIME COMPLETED 16:30  
HNU/OVA, BACKGROUND 0.4 ppm METHOD Bailing  
HNU/OVA, WELL HEAD B6 HNU/OVA, BREATHING ZONE B6  
COMMENTS \_\_\_\_\_





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SAMPLE COLLECTION FIELD SHEET - WATER SAMPLES

PROJECT NAME: Scheller-Globe (3200 Main) PROJECT NUMBER: 9107343  
SAMPLE NUMBER: MW-18 PERSONNEL: D. Kocour  
G. Papinako  
LOCATION DESCRIPTION Facility Parking Lot  
SAMPLE MEDIA (circle one): GROUNDWATER SURFACEWATER OTHER: \_\_\_\_\_  
SAMPLE SPLIT (circle one): YES NO: SPLIT SAMPLE NUMBER: \_\_\_\_\_  
WATER LEVEL: \_\_\_\_\_  
WATER LEVEL MEASUREMENT FROM TOP OF RISER PIPE: 6.39 ft.  
COLLECTION: YR: 92 MO: 4 DAY: 1 TIME: 0920 METHOD: Bailing

SAMPLE CONTAINER	PRESERVATIVE	ANALYSIS REQUESTED
<u>40 ml glass vial</u>	<u>HCL</u>	<u>TCL Volatiles, NCBK</u>
_____	_____	<u>Hexane, Butanol</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

FIELD ANALYSIS

TEMPERATURE, °C 12.0 DATE 11/2/12  
SAMPLE pH 6.7 TIME 0920  
SALINITY, PARTS PER THOU 0 APPEARANCE slightly turbid  
CONDUCTIVITY, umhos/cm 600 ODOR \_\_\_\_\_  
pH BUFFER BEFORE 4.0 - 7.0 pH BUFFER AFTER 4.1 - 7.1  
COMMENTS \_\_\_\_\_

DEVELOPMENT/PURGING

DATE 11/1/12 CASING DIAMETER 2 inches  
WATER LEVEL BEFORE 6.77 WELL DEPTH (SOUNDED) 35.30  
WATER LEVEL AFTER 7.05 TIME STARTED 17:55  
EST. VOLUME REMOVED 15 gals TIME COMPLETED 18:20  
HNU/OVA, BACKGROUND 0.4 ppm METHOD Bailing  
HNU/OVA, WELL HEAD BG HNU/OVA, BREATHING ZONE B6  
COMMENTS \_\_\_\_\_





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Overland Park, Kansas 66203  
(913) 432-4242

## SAMPLE COLLECTION FIELD SHEET - WATER SAMPLES

PROJECT NAME: SHELLER - GLOBE PROJECT NUMBER: 91C7343  
SAMPLE NUMBER: MW-13 PERSONNEL: T. Andrews,  
G. Papinako  
LOCATION DESCRIPTION 3200 Main Street - Employees Parking lot  
SAMPLE MEDIA (circle one): GROUNDWATER SURFACEWATER OTHER: \_\_\_\_\_  
SAMPLE SPLIT (circle one): YES (NO) SPLIT SAMPLE NUMBER: \_\_\_\_\_  
WATER LEVEL: \_\_\_\_\_  
WATER LEVEL MEASUREMENT FROM TOP OF RISER PIPE: 2.79  
COLLECTION: YR: 93 MO: 01 DAY: 27 TIME: 8:30 METHOD: Bailing

SAMPLE CONTAINER	PRESERVATIVE	ANALYSIS REQUESTED
<u>30 ml glass vial (3</u>	<u>HCl + Cool 4°C</u>	<u>TCL Volatiles +</u>
_____	_____	<u>MIBK, Butanol,</u>
_____	_____	<u>Hexane - Method 8240</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

## FIELD ANALYSIS

TEMPERATURE, °C 7 DATE # 93/01/27  
SAMPLE pH 2.0 6.6 TIME 8:30  
SALINITY, PARTS PER THOU 2.0 APPEARANCE Clear  
CONDUCTIVITY, umhos/cm 1300 ODOR None  
pH BUFFER BEFORE 4.0 - 7.0 pH BUFFER AFTER \_\_\_\_\_  
COMMENTS \_\_\_\_\_

## DEVELOPMENT/PURGING

DATE 01-26-93 CASING DIAMETER 2.0 inch  
WATER LEVEL BEFORE 2.68 WELL DEPTH (SOUNDED) 27.9  
WATER LEVEL AFTER \_\_\_\_\_ TIME STARTED \_\_\_\_\_  
EST. VOLUME REMOVED 15 gals TIME COMPLETED \_\_\_\_\_  
HNU/OVA, BACKGROUND 0.4 ppm METHOD Bailing w/ stainless steel bailer  
HNU/OVA, WELL HEAD 22 ppm HNU/OVA, BREATHING ZONE 0.4 ppm  
COMMENTS \_\_\_\_\_





# WOODWARD-CLYDE CONSULTANTS

5055 Antioch Road  
Overland Park, Kansas 66203  
(913) 432-4242

## SAMPLE COLLECTION FIELD SHEET - WATER SAMPLES

PROJECT NAME: SHELLER - GLOBE PROJECT NUMBER: 91C7343  
SAMPLE NUMBER: MW - 13A PERSONNEL: Terry Andrews  
Gene Papinako  
LOCATION DESCRIPTION Monitoring well cluster  
SAMPLE MEDIA (circle one): GROUNDWATER SURFACEWATER OTHER: \_\_\_\_\_  
SAMPLE SPLIT (circle one): YES (NO) : SPLIT SAMPLE NUMBER: \_\_\_\_\_  
WATER LEVEL: \_\_\_\_\_  
WATER LEVEL MEASUREMENT FROM TOP OF RISER PIPE: 2.15  
COLLECTION: YR: 93 MO: 01 DAY: 27 TIME: 8:15 METHOD: Bailing

SAMPLE CONTAINER	PRESERVATIVE	ANALYSIS REQUESTED
<u>30ml glass Vial (3)</u>	<u>HCl</u>	<u>TCI Volatiles,</u>
		<u>MIBK, Hexane,</u>
		<u>Butanol</u>

### FIELD ANALYSIS

TEMPERATURE, °C 7 DATE 01/27/93  
SAMPLE pH 6.4 TIME 8:15  
SALINITY, PARTS PER THOU 3 APPEARANCE Slightly opaque  
CONDUCTIVITY, umhos/cm 2350 ODOR None  
pH BUFFER BEFORE 4.2 - 7.0 pH BUFFER AFTER 4.3 - 7.0  
COMMENTS \_\_\_\_\_

### DEVELOPMENT/PURGING

DATE 01-26-93 CASING DIAMETER 2.0 inch.  
WATER LEVEL BEFORE 2.29 WELL DEPTH (SOUNDED) 10.3  
WATER LEVEL AFTER Bailed dry TIME STARTED \_\_\_\_\_  
EST. VOLUME REMOVED 5 gals TIME COMPLETED \_\_\_\_\_  
HNU/OVA, BACKGROUND 0.4 ppm METHOD Bailing w/ teflon bailer  
HNU/OVA, WELL HEAD 130 ppm HNU/OVA, BREATHING ZONE 0.4 ppm  
COMMENTS \_\_\_\_\_



**WOODWARD-CLYDE CONSULTANTS**

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Overland Park, Kansas 66203  
(913) 432-4242

**SAMPLE COLLECTION FIELD SHEET - WATER SAMPLES**

PROJECT NAME: SHELLER - GLOBE PROJECT NUMBER: 91C7343  
SAMPLE NUMBER: MW-13B PERSONNEL: T. Andrews  
G. Papinako  
LOCATION DESCRIPTION Monitoring well @ the Parking Lot  
SAMPLE MEDIA (circle one): GROUNDWATER SURFACEWATER OTHER: \_\_\_\_\_  
SAMPLE SPLIT (circle one): YES (NO) : SPLIT SAMPLE NUMBER: \_\_\_\_\_  
WATER LEVEL: \_\_\_\_\_  
WATER LEVEL MEASUREMENT FROM TOP OF RISER PIPE: 34.68  
COLLECTION: YR: 93 MO: 01 DAY: 27 TIME: 8:45 METHOD: Bailing

SAMPLE CONTAINER	PRESERVATIVE	ANALYSIS REQUESTED
<u>30 ml vial (3)</u>	<u>HCl</u>	<u>TCL Volatiles,</u>
		<u>MIBK, Hexane,</u>
		<u>Butanol</u>

**FIELD ANALYSIS**

TEMPERATURE, °C 12 DATE 01/27/97  
SAMPLE pH 6.6 TIME 8:45  
SALINITY, PARTS PER THOU 1.5 APPEARANCE Clear  
CONDUCTIVITY, umhos/cm 1150 ODOR None  
pH BUFFER BEFORE 7.0 - 4.1 pH BUFFER AFTER 6.8 - 7.2  
COMMENTS \_\_\_\_\_

**DEVELOPMENT/PURGING**

DATE ~~93~~ 93/01/26 CASING DIAMETER 2.0 inch  
WATER LEVEL BEFORE 1.17 WELL DEPTH (SOUNDED) 50.1  
WATER LEVEL AFTER Bailed dry TIME STARTED \_\_\_\_\_  
EST. VOLUME REMOVED ~ 13 gals TIME COMPLETED \_\_\_\_\_  
HNU/OVA, BACKGROUND 0.4 ppm METHOD Bailing w/ stainless steel bailer  
HNU/OVA, WELL HEAD 0.4 ppm HNU/OVA, BREATHING ZONE 0.4 ppm  
COMMENTS \_\_\_\_\_



**APPENDIX D**  
**ENSECO ANALYTICAL REPORTS**

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ANALYTICAL RESULTS  
FOR  
WOODWARD-CLYDE CONSULTANTS  
ENSECO-RMAL NO. 026066  
  
NOVEMBER 17, 1992







November 17, 1992

Mr. Dave Kocour  
Woodward-Clyde Consultants  
5055 Antioch Road  
Overland Park, KS 66203-0777

Dear Mr. Kocour:

Enclosed is the report for 12 aqueous samples received at Enseco-Rocky Mountain Analytical Laboratory on November 11, 1992.

Included with the report is a quality control summary.

Please call if you have any questions.

Sincerely,

Keith M. Beauvais  
Program Administrator

KMB/ki  
Enclosures

RMAL #026066  
United Technologies



ANALYTICAL RESULTS  
FOR  
WOODWARD-CLYDE CONSULTANTS  
ENSECO-RMAL NO. 026066



NOVEMBER 17, 1992

Reviewed by:

Keith M. Beauvais  
*Keith M. Beauvais*



## Introduction

This report presents the analytical results as well as supporting information to aid in the evaluation and interpretation of the data and is arranged in the following order:

- o Sample Description Information
- o Analytical Test Requests
- o Analytical Results
- o Quality Control Report

Samples 026066-0001, -0003 and -0011 were diluted for Method 8240 due to the presence of target compounds. The non-target compound, Trichlorofluoromethane was also detected at high levels. The presence of this compound was confirmed against a standard. Samples 026066-0004 and -0005 were also diluted for Method 8240 due to the presence of target compounds. The reporting limits have been adjusted relative to the required dilution.

Butanol was searched for by mass chromatogram and not detected.

## Sample Description Information

The Sample Description Information lists all of the samples received in this project together with the internal laboratory identification number assigned for each sample. Each project received at Enseco - RMAL is assigned a unique six digit number. Samples within the project are numbered sequentially. The laboratory identification number is a combination of the six digit project code and the sample sequence number.

Also given in the Sample Description Information is the Sample Type (matrix), Date of Sampling (if known) and Date of Receipt at the laboratory.

## Analytical Test Requests

The Analytical Test Requests lists the analyses that were performed on each sample. The Custom Test column indicates where tests have been modified to conform to the specific requirements of this project.



ANALYTICAL TEST REQUESTS  
for  
Woodward-Clyde Consultants

Lab ID: 026066	Group Code	Analysis Description	Custom Test?
0001 - 0012	A	Volatile Organics Target Compound List (TCL) Screen - Volatile Organics	Y Y N



SAMPLE DESCRIPTION INFORMATION  
for  
Woodward-Clyde Consultants

Lab ID	Client ID	Matrix	Sampled		Received
			Date	Time	
026066-0001-SA	MW-10	WATER	02 NOV 92	08:00	03 NOV 92
026066-0002-SA	MW-11	WATER	02 NOV 92	08:15	03 NOV 92
026066-0003-SA	MW-13	WATER	02 NOV 92	08:30	03 NOV 92
026066-0004-SA	MW-13A	WATER	02 NOV 92	08:45	03 NOV 92
026066-0005-SA	MW-13B	WATER	02 NOV 92	09:00	03 NOV 92
026066-0006-SA	MW-14	WATER	02 NOV 92	09:15	03 NOV 92
026066-0007-SA	MW-16	WATER	02 NOV 92	09:30	03 NOV 92
026066-0008-SA	MW-17A	WATER	02 NOV 92	09:45	03 NOV 92
026066-0009-SA	MW-17B	WATER	02 NOV 92	10:00	03 NOV 92
026066-0010-SA	MW-18	WATER	02 NOV 92	10:15	03 NOV 92
026066-0011-SA	MW-19	WATER	02 NOV 92	08:00	03 NOV 92
026066-0012-TB	TRIP BLANK	WATER	02 NOV 92		03 NOV 92



Volatile Organics  
 Target Compound List (TCL)  
 Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-10

Lab ID: 026066-0001-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 08 NOV 92

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	2000
Benzene	ND	ug/L	1000
Bromodichloromethane	ND	ug/L	1000
Bromoform	ND	ug/L	1000
Bromomethane	ND	ug/L	2000
2-Butanone (MEK)	ND	ug/L	2000
Carbon disulfide	ND	ug/L	1000
Carbon tetrachloride	ND	ug/L	1000
Chlorobenzene	ND	ug/L	1000
Chloroethane	ND	ug/L	2000
Chloroform	ND	ug/L	1000
Chloromethane	ND	ug/L	2000
Dibromochloromethane	ND	ug/L	1000
1,1-Dichloroethane	ND	ug/L	1000
1,2-Dichloroethane	ND	ug/L	1000
1,1-Dichloroethene	ND	ug/L	1000
1,2-Dichloroethene	ND	ug/L	1000
(total)	ND	ug/L	1000
1,2-Dichloropropane	ND	ug/L	1000
cis-1,3-Dichloropropene	ND	ug/L	1000
trans-1,3-Dichloropropene	ND	ug/L	1000
Ethylbenzene	ND	ug/L	1000
2-Hexanone	ND	ug/L	2000
Methylene chloride	12000	ug/L	1000
4-Methyl-2-pentanone	ND	ug/L	2000
(MIBK)	ND	ug/L	1000
Styrene	ND	ug/L	1000
1,1,2,2-Tetrachloroethane	ND	ug/L	1000
Tetrachloroethene	ND	ug/L	1000
Toluene	ND	ug/L	1000
1,1,1-Trichloroethane	1200	ug/L	1000
1,1,2-Trichloroethane	ND	ug/L	1000
Trichloroethene	1800	ug/L	1000
Vinyl acetate	ND	ug/L	2000
Vinyl chloride	ND	ug/L	2000
Xylenes (total)	ND	ug/L	1000
4-Methyl-2-pentanone	ND	ug/L	1000
Hexane	ND	ug/L	1000

(continued on following page)

ND = Not detected  
 NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-10

Lab ID: 026066-0001-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 08 NOV 92

Surrogate

Recovery

Toluene-d8	104	%
4-Bromofluorobenzene	101	%
1,2-Dichloroethane-d4	93	%

ND = Not detected  
NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
 Target Compound List (TCL)  
 Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-11

Lab ID: 026066-0002-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 06 NOV 92

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	10
Benzene	ND	ug/L	5.0
Bromodichloromethane	ND	ug/L	5.0
Bromoform	ND	ug/L	5.0
Bromomethane	ND	ug/L	10
2-Butanone (MEK)	ND	ug/L	10
Carbon disulfide	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Chloroethane	ND	ug/L	10
Chloroform	ND	ug/L	5.0
Chloromethane	ND	ug/L	10
Dibromochloromethane	ND	ug/L	5.0
1,1-Dichloroethane	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	5.0
1,2-Dichloroethene			
(total)	6.0	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Ethylbenzene	ND	ug/L	5.0
2-Hexanone	ND	ug/L	10
Methylene chloride	ND	ug/L	5.0
4-Methyl-2-pentanone			
(MIBK)	ND	ug/L	10
Styrene	ND	ug/L	5.0
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0
Tetrachloroethene	ND	ug/L	5.0
Toluene	ND	ug/L	5.0
1,1,1-Trichloroethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0
Vinyl acetate	ND	ug/L	10
Vinyl chloride	ND	ug/L	10
Xylenes (total)	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	5.0
Hexane	ND	ug/L	5.0

(continued on following page)

ND = Not detected  
 NA = Not applicable

Reported By: Keith Campbell

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-11

Lab ID: 026066-0002-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 06 NOV 92

Surrogate

Recovery

Toluene-d8	105	%
4-Bromofluorobenzene	105	%
1,2-Dichloroethane-d4	104	%

ND = Not detected  
NA = Not applicable

Reported By: Keith Campbell

Approved By: Audrey Verniero



Volatile Organics  
 Target Compound List (TCL)  
 Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-13

Lab ID: 026066-0003-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 09 NOV 92

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	5000
Benzene	ND	ug/L	2500
Bromodichloromethane	ND	ug/L	2500
Bromoform	ND	ug/L	2500
Bromomethane	ND	ug/L	5000
2-Butanone (MEK)	ND	ug/L	5000
Carbon disulfide	ND	ug/L	2500
Carbon tetrachloride	ND	ug/L	2500
Chlorobenzene	ND	ug/L	2500
Chloroethane	ND	ug/L	5000
Chloroform	ND	ug/L	2500
Chloromethane	ND	ug/L	5000
Dibromochloromethane	ND	ug/L	2500
1,1-Dichloroethane	ND	ug/L	2500
1,2-Dichloroethane	ND	ug/L	2500
1,1-Dichloroethene	ND	ug/L	2500
1,2-Dichloroethene	ND	ug/L	2500
(total)	ND	ug/L	2500
1,2-Dichloropropane	ND	ug/L	2500
cis-1,3-Dichloropropene	ND	ug/L	2500
trans-1,3-Dichloropropene	ND	ug/L	2500
Ethylbenzene	ND	ug/L	2500
2-Hexanone	ND	ug/L	5000
Methylene chloride	91000	ug/L	2500
4-Methyl-2-pentanone	ND	ug/L	5000
(MIBK)	ND	ug/L	5000
Styrene	ND	ug/L	2500
1,1,2,2-Tetrachloroethane	ND	ug/L	2500
Tetrachloroethene	2700	ug/L	2500
Toluene	33000	ug/L	2500
1,1,1-Trichloroethane	ND	ug/L	2500
1,1,2-Trichloroethane	ND	ug/L	2500
Trichloroethene	6000	ug/L	2500
Vinyl acetate	ND	ug/L	5000
Vinyl chloride	ND	ug/L	5000
Xylenes (total)	2900	ug/L	2500
4-Methyl-2-pentanone	ND	ug/L	2500
Hexane	ND	ug/L	2500

(continued on following page)

ND = Not detected  
 NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-13

Lab ID: 026066-0003-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 09 NOV 92

Surrogate

Recovery

Toluene-d8

101 %

4-Bromofluorobenzene

100 %

1,2-Dichloroethane-d4

93 %

ND = Not detected  
NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-13A

Lab ID: 026066-0004-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 06 NOV 92

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	1200
Benzene	ND	ug/L	620
Bromodichloromethane	ND	ug/L	620
Bromoform	ND	ug/L	620
Bromomethane	ND	ug/L	1200
2-Butanone (MEK)	ND	ug/L	1200
Carbon disulfide	ND	ug/L	620
Carbon tetrachloride	ND	ug/L	620
Chlorobenzene	ND	ug/L	620
Chloroethane	ND	ug/L	1200
Chloroform	ND	ug/L	620
Chloromethane	ND	ug/L	1200
Dibromochloromethane	ND	ug/L	620
1,1-Dichloroethane	ND	ug/L	620
1,2-Dichloroethane	ND	ug/L	620
1,1-Dichloroethene	ND	ug/L	620
1,2-Dichloroethene	ND	ug/L	620
(total)	ND	ug/L	620
1,2-Dichloropropane	ND	ug/L	620
cis-1,3-Dichloropropene	ND	ug/L	620
trans-1,3-Dichloropropene	ND	ug/L	620
Ethylbenzene	2300	ug/L	620
2-Hexanone	ND	ug/L	1200
Methylene chloride	ND	ug/L	620
4-Methyl-2-pentanone	ND	ug/L	1200
(MIBK)	ND	ug/L	620
Styrene	ND	ug/L	620
1,1,2,2-Tetrachloroethane	ND	ug/L	620
Tetrachloroethene	ND	ug/L	620
Toluene	ND	ug/L	620
1,1,1-Trichloroethane	ND	ug/L	620
1,1,2-Trichloroethane	ND	ug/L	620
Trichloroethene	ND	ug/L	620
Vinyl acetate	ND	ug/L	1200
Vinyl chloride	ND	ug/L	1200
Xylenes (total)	8600	ug/L	620
4-Methyl-2-pentanone	ND	ug/L	620
Hexane	ND	ug/L	620

(continued on following page)

ND = Not detected  
NA = Not applicable

Reported By: Keith Campbell

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-13A

Lab ID: 026066-0004-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 06 NOV 92

Surrogate

Recovery

Toluene-d8	105	%
4-Bromofluorobenzene	106	%
1,2-Dichloroethane-d4	109	%

ND = Not detected  
NA = Not applicable

Reported By: Keith Campbell

Approved By: Audrey Verniero



Volatile Organics  
 Target Compound List (TCL)  
 Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-13B

Lab ID: 026066-0005-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 10 NOV 92

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	170
Benzene	ND	ug/L	85
Bromodichloromethane	ND	ug/L	85
Bromoform	ND	ug/L	85
Bromomethane	ND	ug/L	170
2-Butanone (MEK)	ND	ug/L	170
Carbon disulfide	ND	ug/L	85
Carbon tetrachloride	ND	ug/L	85
Chlorobenzene	ND	ug/L	85
Chloroethane	ND	ug/L	170
Chloroform	ND	ug/L	85
Chloromethane	ND	ug/L	170
Dibromochloromethane	ND	ug/L	85
1,1-Dichloroethane	ND	ug/L	85
1,2-Dichloroethane	ND	ug/L	85
1,1-Dichloroethene	ND	ug/L	85
1,2-Dichloroethene	ND	ug/L	85
(total)	ND	ug/L	85
1,2-Dichloropropane	ND	ug/L	85
cis-1,3-Dichloropropene	ND	ug/L	85
trans-1,3-Dichloropropene	ND	ug/L	85
Ethylbenzene	ND	ug/L	85
2-Hexanone	ND	ug/L	170
Methylene chloride	1900	ug/L	85
4-Methyl-2-pentanone	ND	ug/L	170
(MIBK)	ND	ug/L	85
Styrene	ND	ug/L	85
1,1,2,2-Tetrachloroethane	ND	ug/L	85
Tetrachloroethene	ND	ug/L	85
Toluene	ND	ug/L	85
1,1,1-Trichloroethane	ND	ug/L	85
1,1,2-Trichloroethane	ND	ug/L	85
Trichloroethene	ND	ug/L	85
Vinyl acetate	ND	ug/L	170
Vinyl chloride	ND	ug/L	170
Xylenes (total)	ND	ug/L	85
4-Methyl-2-pentanone	ND	ug/L	85
Hexane	ND	ug/L	85

(continued on following page)

ND = Not detected  
 NA = Not applicable

Reported By: Dianne Buckheister

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-13B

Lab ID: 026066-0005-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 10 NOV 92

Surrogate

Recovery

Toluene-d8

107 %

4-Bromofluorobenzene

95 %

1,2-Dichloroethane-d4

96 %

ND = Not detected  
NA = Not applicable

Reported By: Dianne Buckheister

Approved By: Audrey Verniero



Volatile Organics  
 Target Compound List (TCL)  
 Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-14

Lab ID: 026066-0006-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 10 NOV 92

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	10
Benzene	ND	ug/L	5.0
Bromodichloromethane	ND	ug/L	5.0
Bromoform	ND	ug/L	5.0
Bromomethane	ND	ug/L	10
2-Butanone (MEK)	ND	ug/L	10
Carbon disulfide	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Chloroethane	ND	ug/L	10
Chloroform	ND	ug/L	5.0
Chloromethane	ND	ug/L	10
Dibromochloromethane	ND	ug/L	5.0
1,1-Dichloroethane	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	5.0
1,2-Dichloroethene	ND	ug/L	5.0
(total)	ND	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Ethylbenzene	ND	ug/L	5.0
2-Hexanone	ND	ug/L	10
Methylene chloride	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	10
(MIBK)	ND	ug/L	5.0
Styrene	ND	ug/L	5.0
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0
Tetrachloroethene	ND	ug/L	5.0
Toluene	ND	ug/L	5.0
1,1,1-Trichloroethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0
Vinyl acetate	ND	ug/L	10
Vinyl chloride	ND	ug/L	10
Xylenes (total)	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	5.0
Hexane	ND	ug/L	5.0

(continued on following page)

ND = Not detected  
 NA = Not applicable

Reported By: Dianne Buckheister

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-14

Lab ID: 026066-0006-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 10 NOV 92

Surrogate

Recovery

Toluene-d8

106 %

4-Bromofluorobenzene

98 %

1,2-Dichloroethane-d4

101 %

ND = Not detected  
NA = Not applicable

Reported By: Dianne Buckheister

Approved By: Audrey Verniero



Volatile Organics  
 Target Compound List (TCL)  
 Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-16

Lab ID: 026066-0007-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 10 NOV 92

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	10
Benzene	ND	ug/L	5.0
Bromodichloromethane	ND	ug/L	5.0
Bromoform	ND	ug/L	5.0
Bromomethane	ND	ug/L	10
2-Butanone (MEK)	ND	ug/L	10
Carbon disulfide	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Chloroethane	ND	ug/L	10
Chloroform	ND	ug/L	5.0
Chloromethane	ND	ug/L	10
Dibromochloromethane	ND	ug/L	5.0
1,1-Dichloroethane	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	5.0
1,2-Dichloroethene	ND	ug/L	5.0
(total)	ND	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Ethylbenzene	ND	ug/L	5.0
2-Hexanone	ND	ug/L	10
Methylene chloride	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	10
(MIBK)	ND	ug/L	5.0
Styrene	ND	ug/L	5.0
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0
Tetrachloroethene	ND	ug/L	5.0
Toluene	ND	ug/L	5.0
1,1,1-Trichloroethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0
Vinyl acetate	ND	ug/L	10
Vinyl chloride	ND	ug/L	10
Xylenes (total)	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	5.0
Hexane	ND	ug/L	5.0

(continued on following page)

ND = Not detected  
 NA = Not applicable

Reported By: Dianne Buckheister

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-16

Lab ID: 026066-0007-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 10 NOV 92

Surrogate

Recovery

Toluene-d8

108 %

4-Bromofluorobenzene

100 %

1,2-Dichloroethane-d4

104 %

ND = Not detected  
NA = Not applicable

Reported By: Dianne Buckheister

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-17A

Lab ID: 026066-0008-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 09 NOV 92

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	10
Benzene	ND	ug/L	5.0
Bromodichloromethane	ND	ug/L	5.0
Bromoform	ND	ug/L	5.0
Bromomethane	ND	ug/L	10
2-Butanone (MEK)	ND	ug/L	10
Carbon disulfide	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Chloroethane	ND	ug/L	10
Chloroform	ND	ug/L	5.0
Chloromethane	ND	ug/L	10
Dibromochloromethane	ND	ug/L	5.0
1,1-Dichloroethane	7.0	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	5.0
1,2-Dichloroethene			
(total)	5.8	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Ethylbenzene	ND	ug/L	5.0
2-Hexanone	ND	ug/L	10
Methylene chloride	ND	ug/L	5.0
4-Methyl-2-pentanone			
(MIBK)	ND	ug/L	10
Styrene	ND	ug/L	5.0
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0
Tetrachloroethene	ND	ug/L	5.0
Toluene	ND	ug/L	5.0
1,1,1-Trichloroethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0
Vinyl acetate	ND	ug/L	10
Vinyl chloride	ND	ug/L	10
Xylenes (total)	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	5.0
Hexane	ND	ug/L	5.0

(continued on following page)

ND = Not detected  
NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-17A

Lab ID: 026066-0008-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 09 NOV 92

Surrogate

Recovery

Toluene-d8

101 %

4-Bromofluorobenzene

98 %

1,2-Dichloroethane-d4

95 %

ND = Not detected  
NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
 Target Compound List (TCL)  
 Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-17B

Lab ID: 026066-0009-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 09 NOV 92

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	10
Benzene	ND	ug/L	5.0
Bromodichloromethane	ND	ug/L	5.0
Bromoform	ND	ug/L	5.0
Bromomethane	ND	ug/L	10
2-Butanone (MEK)	ND	ug/L	10
Carbon disulfide	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Chloroethane	ND	ug/L	10
Chloroform	ND	ug/L	5.0
Chloromethane	ND	ug/L	10
Dibromochloromethane	ND	ug/L	5.0
1,1-Dichloroethane	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	5.0
1,2-Dichloroethene	ND	ug/L	5.0
(total)	ND	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Ethylbenzene	ND	ug/L	5.0
2-Hexanone	ND	ug/L	10
Methylene chloride	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	10
(MIBK)	ND	ug/L	10
Styrene	ND	ug/L	5.0
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0
Tetrachloroethene	ND	ug/L	5.0
Toluene	ND	ug/L	5.0
1,1,1-Trichloroethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0
Vinyl acetate	ND	ug/L	10
Vinyl chloride	ND	ug/L	10
Xylenes (total)	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	5.0
Hexane	ND	ug/L	5.0

(continued on following page)

ND = Not detected  
 NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-17B

Lab ID: 026066-0009-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 09 NOV 92

Surrogate

Recovery

Toluene-d8	99	%
4-Bromofluorobenzene	99	%
1,2-Dichloroethane-d4	95	%

ND = Not detected  
NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
 Target Compound List (TCL)  
 Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-18

Lab ID: 026066-0010-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 09 NOV 92

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	10
Benzene	ND	ug/L	5.0
Bromodichloromethane	ND	ug/L	5.0
Bromoform	ND	ug/L	5.0
Bromomethane	ND	ug/L	10
2-Butanone (MEK)	ND	ug/L	10
Carbon disulfide	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Chloroethane	ND	ug/L	10
Chloroform	ND	ug/L	5.0
Chloromethane	ND	ug/L	10
Dibromochloromethane	ND	ug/L	5.0
1,1-Dichloroethane	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	5.0
1,2-Dichloroethene	ND	ug/L	5.0
(total)	ND	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Ethylbenzene	ND	ug/L	5.0
2-Hexanone	ND	ug/L	10
Methylene chloride	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	10
(MIBK)	ND	ug/L	5.0
Styrene	ND	ug/L	5.0
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0
Tetrachloroethene	ND	ug/L	5.0
Toluene	ND	ug/L	5.0
1,1,1-Trichloroethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0
Vinyl acetate	ND	ug/L	10
Vinyl chloride	ND	ug/L	10
Xylenes (total)	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	5.0
Hexane	ND	ug/L	5.0

(continued on following page)

ND = Not detected  
 NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-18

Lab ID: 026066-0010-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 09 NOV 92

Surrogate

Recovery

Toluene-d8

102 %

4-Bromofluorobenzene

97 %

1,2-Dichloroethane-d4

97 %

ND = Not detected  
NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
 Target Compound List (TCL)  
 Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-19

Lab ID: 026066-0011-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 10 NOV 92

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	2000
Benzene	ND	ug/L	1000
Bromodichloromethane	ND	ug/L	1000
Bromoform	ND	ug/L	1000
Bromomethane	ND	ug/L	2000
2-Butanone (MEK)	ND	ug/L	2000
Carbon disulfide	ND	ug/L	1000
Carbon tetrachloride	ND	ug/L	1000
Chlorobenzene	ND	ug/L	1000
Chloroethane	ND	ug/L	2000
Chloroform	ND	ug/L	1000
Chloromethane	ND	ug/L	2000
Dibromochloromethane	ND	ug/L	1000
1,1-Dichloroethane	ND	ug/L	1000
1,2-Dichloroethane	ND	ug/L	1000
1,1-Dichloroethene	ND	ug/L	1000
1,2-Dichloroethene	ND	ug/L	1000
(total)	ND	ug/L	1000
1,2-Dichloropropane	ND	ug/L	1000
cis-1,3-Dichloropropene	ND	ug/L	1000
trans-1,3-Dichloropropene	ND	ug/L	1000
Ethylbenzene	ND	ug/L	1000
2-Hexanone	ND	ug/L	2000
Methylene chloride	10000	ug/L	1000
4-Methyl-2-pentanone	ND	ug/L	2000
(MIBK)	ND	ug/L	1000
Styrene	ND	ug/L	1000
1,1,2,2-Tetrachloroethane	ND	ug/L	1000
Tetrachloroethene	ND	ug/L	1000
Toluene	ND	ug/L	1000
1,1,1-Trichloroethane	ND	ug/L	1000
1,1,2-Trichloroethane	ND	ug/L	1000
Trichloroethene	1400	ug/L	1000
Vinyl acetate	ND	ug/L	2000
Vinyl chloride	ND	ug/L	2000
Xylenes (total)	ND	ug/L	1000
4-Methyl-2-pentanone	ND	ug/L	1000
Hexane	ND	ug/L	1000

(continued on following page)

ND = Not detected  
 NA = Not applicable

Reported By: Dianne Buckheister

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-19

Lab ID: 026066-0011-SA

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 10 NOV 92

Surrogate

Recovery

Toluene-d8	106	%
4-Bromofluorobenzene	98	%
1,2-Dichloroethane-d4	103	%

ND = Not detected  
NA = Not applicable

Reported By: Dianne Buckheister

Approved By: Audrey Verniero



Volatile Organics  
 Target Compound List (TCL)  
 Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: TRIP BLANK

Lab ID: 026066-0012-TB

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 09 NOV 92

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	10
Benzene	ND	ug/L	5.0
Bromodichloromethane	ND	ug/L	5.0
Bromoform	ND	ug/L	5.0
Bromomethane	ND	ug/L	10
2-Butanone (MEK)	ND	ug/L	10
Carbon disulfide	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Chloroethane	ND	ug/L	10
Chloroform	ND	ug/L	5.0
Chloromethane	ND	ug/L	10
Dibromochloromethane	ND	ug/L	5.0
1,1-Dichloroethane	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	5.0
1,2-Dichloroethene	ND	ug/L	5.0
(total)	ND	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Ethylbenzene	ND	ug/L	5.0
2-Hexanone	ND	ug/L	10
Methylene chloride	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	10
(MIBK)	ND	ug/L	5.0
Styrene	ND	ug/L	5.0
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0
Tetrachloroethene	ND	ug/L	5.0
Toluene	ND	ug/L	5.0
1,1,1-Trichloroethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0
Vinyl acetate	ND	ug/L	10
Vinyl chloride	ND	ug/L	10
Xylenes (total)	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	5.0
Hexane	ND	ug/L	5.0

(continued on following page)

ND = Not detected  
 NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: TRIP BLANK

Lab ID: 026066-0012-TB

Matrix: WATER

Authorized: 03 NOV 92

Sampled: 02 NOV 92

Prepared: 05 NOV 92

Received: 03 NOV 92

Analyzed: 09 NOV 92

Surrogate

Recovery

Toluene-d8

102 %

4-Bromofluorobenzene

97 %

1,2-Dichloroethane-d4

94 %

ND = Not detected  
NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



QC LOT ASSIGNMENT REPORT  
Volatile Organics by GC/MS

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK)
026066-0001-SA	AQUEOUS	624-A	26 OCT 92-B	08 NOV 92-B
026066-0002-SA	AQUEOUS	624-A	02 NOV 92-H	06 NOV 92-H
026066-0003-SA	AQUEOUS	624-A	26 OCT 92-B	08 NOV 92-B
026066-0004-SA	AQUEOUS	624-A	02 NOV 92-H	06 NOV 92-H
026066-0005-SA	AQUEOUS	624-A	05 NOV 92-H	09 NOV 92-H2
026066-0006-SA	AQUEOUS	624-A	05 NOV 92-H	09 NOV 92-H2
026066-0007-SA	AQUEOUS	624-A	05 NOV 92-H	09 NOV 92-H2
026066-0008-SA	AQUEOUS	624-A	26 OCT 92-B	08 NOV 92-B
026066-0009-SA	AQUEOUS	624-A	26 OCT 92-B	08 NOV 92-B
026066-0010-SA	AQUEOUS	624-A	26 OCT 92-B	08 NOV 92-B
026066-0011-SA	AQUEOUS	624-A	05 NOV 92-H	09 NOV 92-H2
026066-0012-TB	AQUEOUS	624-A	26 OCT 92-B	08 NOV 92-B



**DUPLICATE CONTROL SAMPLE REPORT**  
**Volatile Organics by GC/MS**

Analyte	Spiked	Concentration		AVG	Accuracy		Precision	
		DCS1	Measured DCS2		DCS	Average(%) Limits	(RPD)	DCS Limit

Category: 624-A  
 Matrix: AQUEOUS  
 QC Lot: 26 OCT 92-B  
 Concentration Units: ug/L

1,1-Dichloroethene	50	50.0	48.6	49.3	99	56-138	2.8	20
Trichloroethene	50	44.7	44.6	44.6	89	76-109	0.2	13
Benzene	50	43.6	42.8	43.2	86	78-119	1.9	12
Toluene	50	49.1	48.5	48.8	98	82-114	1.2	13
Chlorobenzene	50	51.1	49.6	50.4	101	84-117	3.0	10

Category: 624-A  
 Matrix: AQUEOUS  
 QC Lot: 02 NOV 92-H  
 Concentration Units: ug/L

1,1-Dichloroethene	50	42.0	40.2	41.1	82	56-138	4.4	20
Trichloroethene	50	45.1	39.5	42.3	85	76-109	13	13
Benzene	50	42.4	39.0	40.7	81	78-119	8.4	12
Toluene	50	48.8	44.2	46.5	93	82-114	9.9	13
Chlorobenzene	50	51.3	45.3	48.3	97	84-117	12	10

Category: 624-A  
 Matrix: AQUEOUS  
 QC Lot: 05 NOV 92-H  
 Concentration Units: ug/L

1,1-Dichloroethene	50	49.8	44.9	47.4	95	56-138	10	20
Trichloroethene	50	46.2	42.1	44.2	88	76-109	9.3	13
Benzene	50	46.5	42.3	44.4	89	78-119	9.5	12
Toluene	50	49.9	44.2	47.0	94	82-114	12	13
Chlorobenzene	50	51.5	45.0	48.2	97	84-117	13	10

Calculations are performed before rounding to avoid round-off errors in calculated results.



# SINGLE CONTROL SAMPLE REPORT Volatile Organics by GC/MS

Analyte	Concentration		Accuracy(%)	
	Spiked	Measured	SCS	Limits
Category: 624-A				
Matrix: AQUEOUS				
QC Lot: 26 OCT 92-B    QC Run: 08 NOV 92-B				
Concentration Units: ug/L				
1,2-Dichloroethane-d4	50.0	47.1	94	82-112
4-Bromofluorobenzene	50.0	47.8	96	83-113
Toluene-d8	50.0	49.0	98	90-112

Category: 624-A				
Matrix: AQUEOUS				
QC Lot: 02 NOV 92-H    QC Run: 06 NOV 92-H				
Concentration Units: ug/L				
1,2-Dichloroethane-d4	50.0	47.3	95	82-112
4-Bromofluorobenzene	50.0	50.9	102	83-113
Toluene-d8	50.0	51.2	102	90-112

Category: 624-A				
Matrix: AQUEOUS				
QC Lot: 05 NOV 92-H    QC Run: 09 NOV 92-H2				
Concentration Units: ug/L				
1,2-Dichloroethane-d4	50.0	48.0	96	82-112
4-Bromofluorobenzene	50.0	48.5	97	83-113
Toluene-d8	50.0	51.9	104	90-112

Calculations are performed before rounding to avoid round-off errors in calculated results.



METHOD BLANK REPORT  
Volatile Organics by GC/MS

Analyte	Result	Units	Reporting Limit
Test: 8240CP-TCL-AP			
Matrix: WATER			
QC Lot: 26 OCT 92-B    QC Run: 08 NOV 92-B			
Acetone	ND	ug/L	10
Benzene	ND	ug/L	5.0
Bromodichloromethane	ND	ug/L	5.0
Bromoform	ND	ug/L	5.0
Bromomethane	ND	ug/L	10
2-Butanone (MEK)	ND	ug/L	10
Carbon disulfide	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Chloroethane	ND	ug/L	10
Chloroform	ND	ug/L	5.0
Chloromethane	ND	ug/L	10
Dibromochloromethane	ND	ug/L	5.0
1,1-Dichloroethane	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	5.0
1,2-Dichloroethene	ND	ug/L	5.0
(total)	ND	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Ethylbenzene	ND	ug/L	5.0
2-Hexanone	ND	ug/L	10
Methylene chloride	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	10
(MIBK)	ND	ug/L	10
Styrene	ND	ug/L	5.0
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0
Tetrachloroethene	ND	ug/L	5.0
Toluene	ND	ug/L	5.0
1,1,1-Trichloroethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0
Vinyl acetate	ND	ug/L	10
Vinyl chloride	ND	ug/L	10
Xylenes (total)	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	5.0
Hexane	ND	ug/L	5.0



METHOD BLANK REPORT  
 Volatile Organics by GC/MS (cont.)

Analyte	Result	Units	Reporting Limit
Test: 8240CP-TCL-AP			
Matrix: WATER			
QC Lot: 02 NOV 92-H    QC Run: 06 NOV 92-H			
Acetone	ND	ug/L	10
Benzene	ND	ug/L	5.0
Bromodichloromethane	ND	ug/L	5.0
Bromoform	ND	ug/L	5.0
Bromomethane	ND	ug/L	10
2-Butanone (MEK)	ND	ug/L	10
Carbon disulfide	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Chloroethane	ND	ug/L	10
Chloroform	ND	ug/L	5.0
Chloromethane	ND	ug/L	10
Dibromochloromethane	ND	ug/L	5.0
1,1-Dichloroethane	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	5.0
1,2-Dichloroethene	ND	ug/L	5.0
(total)	ND	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Ethylbenzene	ND	ug/L	5.0
2-Hexanone	ND	ug/L	10
Methylene chloride	1.2	ug/L	5.0
4-Methyl-2-pentanone			
(MIBK)	ND	ug/L	10
Styrene	ND	ug/L	5.0
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0
Tetrachloroethene	ND	ug/L	5.0
Toluene	ND	ug/L	5.0
1,1,1-Trichloroethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0
Vinyl acetate	ND	ug/L	10
Vinyl chloride	ND	ug/L	10
Xylenes (total)	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	5.0
Hexane	ND	ug/L	5.0

J = Result is detected below the reporting limit or is an estimated concentration.



METHOD BLANK REPORT  
 Volatile Organics by GC/MS (cont.)

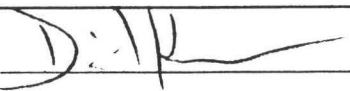
Analyte	Result	Units	Reporting Limit
Test: 8240CP-TCL-AP			
Matrix: WATER			
QC Lot: 05 NOV 92-H QC Run: 09 NOV 92-H2			
Acetone	ND	ug/L	10
Benzene	ND	ug/L	5.0
Bromodichloromethane	ND	ug/L	5.0
Bromoform	ND	ug/L	5.0
Bromomethane	ND	ug/L	10
2-Butanone (MEK)	ND	ug/L	10
Carbon disulfide	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Chloroethane	ND	ug/L	10
Chloroform	ND	ug/L	5.0
Chloromethane	ND	ug/L	10
Dibromochloromethane	ND	ug/L	5.0
1,1-Dichloroethane	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	5.0
1,2-Dichloroethene	ND	ug/L	5.0
(total)	ND	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Ethylbenzene	ND	ug/L	5.0
2-Hexanone	ND	ug/L	10
Methylene chloride	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	10
(MIBK)	ND	ug/L	10
Styrene	ND	ug/L	5.0
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0
Tetrachloroethene	ND	ug/L	5.0
Toluene	ND	ug/L	5.0
1,1,1-Trichloroethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0
Vinyl acetate	ND	ug/L	10
Vinyl chloride	ND	ug/L	10
Xylenes (total)	ND	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	5.0
Hexane	ND	ug/L	5.0



**CHAIN OF CUSTODY**

<b>ENSECO CLIENT</b> WOODWARD Clyde Consultants		<b>SAMPLE SAFE™ CONDITIONS</b>	
<b>PROJECT</b> Facility at 3200 Main, Keokuk, IA 9167343		<b>PACKED BY</b> D. Kocour	<b>SEAL NUMBER</b> NA
<b>SAMPLING COMPANY</b> Woodward Clyde		<b>SEAL INTACT UPON RECEIPT BY SAMPLING COMPANY</b> NA	
<b>SAMPLING SITE</b> 3200 Main, Keokuk, IA		<b>SEALED FOR SHIPPING BY</b> D. Kocour	
<b>TEAM LEADER</b> David Kocour		<b>SEAL NUMBER</b> NA	<b>SAMPLING STATUS</b> <input checked="" type="checkbox"/> Done <input type="checkbox"/> Continuing Until
		<b>SEAL INTACT UPON RECEIPT BY LAB.</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	
		<b>CONTENTS TEMPERATURE UPON RECEIPT BY LAB.</b> 5.2 °C	

DATE	TIME	SAMPLE ID/DESCRIPTION	SAMPLE TYPE	# CONTAINERS	ANALYSIS PARAMETERS	REMARKS
11/2/92	0800	MW-10	Water	3	TCL Volatiles + MIBK, Hexane, and Butanol	
"	0815	MW-11	"	"	"	
"	0830	MW-13	"	"	"	
"	0845	MW-13A	"	"	"	
"	0900	MW-13B	"	"	"	
"	0915	MW-14	"	"	"	
"	0930	MW-16	"	"	"	
"	0945	MW-17A	"	"	"	
"	1000	MW-17B	"	"	"	
"	1015	MW-18	"	"	"	

CUSTODY TRANSFERS PRIOR TO SHIPPING				SHIPPING DETAILS	
<b>RELINQUISHED BY (SIGNED)</b> 	<b>RECEIVED BY (SIGNED)</b>  	<b>DATE</b> 11/2/92	<b>TIME</b> 4:45PM	<b>DELIVERED TO SHIPPER BY</b> D. Kocour	<b>METHOD OF SHIPMENT</b> Federal Express
				<b>RECEIVED FOR LAB</b> RMAL	<b>AIRBILL NUMBER</b> 5346676254
				<b>ENSECO PROJECT NUMBER</b> 26066	<b>DATE/TIME</b> 11-3-92 08:38





Rocky Mountain Analytical Laboratory  
4955 Yarrow Street  
Arvada, CO 80002  
303/421-6611 FAX: 303/431-7171

## CHAIN OF CUSTODY

<b>ENSECO CLIENT</b> Woodward Clyde Consultants <b>PROJECT</b> Facility at 3200 Main, Keokuk, IA 51023 <b>SAMPLING COMPANY</b> Woodward Clyde <b>SAMPLING SITE</b> 3200 Main, Keokuk, IA <b>TEAM LEADER</b> David Kocour		<b>SAMPLE SAFE™ CONDITIONS</b> <table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%; vertical-align: top;"> <b>PACKED BY</b>          D. Kocour  <b>SEAL INTACT UPON RECEIPT BY SAMPLING COMPANY</b>          D. Kocour  <b>SEALED FOR SHIPPING BY</b>          D. Kocour  <b>SEAL NUMBER</b>          NA  <b>SEAL INTACT UPON RECEIPT BY LAB.</b>  <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No       </td> <td style="width:50%; vertical-align: top;"> <b>SEAL NUMBER</b>          NA  <b>CONDITION OF CONTENTS</b>          Intact  <b>INITIAL CONTENTS TEMP.</b>          11 °C  <b>SAMPLING STATUS</b>  <input checked="" type="checkbox"/> Done <input type="checkbox"/> Continuing Until  <b>CONTENTS TEMPERATURE UPON RECEIPT BY LAB.</b>          5.2 °C       </td> </tr> </table>		<b>PACKED BY</b> D. Kocour <b>SEAL INTACT UPON RECEIPT BY SAMPLING COMPANY</b> D. Kocour <b>SEALED FOR SHIPPING BY</b> D. Kocour <b>SEAL NUMBER</b> NA <b>SEAL INTACT UPON RECEIPT BY LAB.</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<b>SEAL NUMBER</b> NA <b>CONDITION OF CONTENTS</b> Intact <b>INITIAL CONTENTS TEMP.</b> 11 °C <b>SAMPLING STATUS</b> <input checked="" type="checkbox"/> Done <input type="checkbox"/> Continuing Until <b>CONTENTS TEMPERATURE UPON RECEIPT BY LAB.</b> 5.2 °C
<b>PACKED BY</b> D. Kocour <b>SEAL INTACT UPON RECEIPT BY SAMPLING COMPANY</b> D. Kocour <b>SEALED FOR SHIPPING BY</b> D. Kocour <b>SEAL NUMBER</b> NA <b>SEAL INTACT UPON RECEIPT BY LAB.</b> <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	<b>SEAL NUMBER</b> NA <b>CONDITION OF CONTENTS</b> Intact <b>INITIAL CONTENTS TEMP.</b> 11 °C <b>SAMPLING STATUS</b> <input checked="" type="checkbox"/> Done <input type="checkbox"/> Continuing Until <b>CONTENTS TEMPERATURE UPON RECEIPT BY LAB.</b> 5.2 °C				

DATE	TIME	SAMPLE ID/DESCRIPTION	SAMPLE TYPE	# CONTAINERS	ANALYSIS PARAMETERS	REMARKS
11/2/92	0800	MW-19	Water	3	TCL Volatiles + MIBK, Hexane, + Butanol	
11/2/92		Trip Blanks	"	"	"	

CUSTODY TRANSFERS PRIOR TO SHIPPING				SHIPPING DETAILS	
<b>RELINQUISHED BY (SIGNED)</b> D. Kocour	<b>RECEIVED BY (SIGNED)</b>  	<b>DATE</b> 11/2/92	<b>TIME</b> 4:45 AM	<b>DELIVERED TO SHIPPER BY</b> D. Kocour <b>METHOD OF SHIPMENT</b> Federal Express <b>RECEIVED FOR LAB</b> KUAL <b>ENSECO PROJECT NUMBER</b>  	<b>AIRBILL NUMBER</b> 5366676254 <b>SIGNED</b> [Signature] <b>DATE/TIME</b> 11-3-92 8:38



ANALYTICAL RESULTS  
FOR  
WOODWARD-CLYDE CONSULTANTS  
ENSECO-RMAL NO. 027367  
  
FEBRUARY 5, 1993





ANALYTICAL RESULTS  
FOR  
WOODWARD-CLYDE CONSULTANTS  
ENSECO-RMAL NO. 027367



FEBRUARY 5, 1993

Reviewed by:

Debbie Arzu (for)  
Jean Zimmerman



## Introduction

This report presents the analytical results as well as supporting information to aid in the evaluation and interpretation of the data and is arranged in the following order:

- o Sample Description Information
- o Analytical Test Requests
- o Analytical Results
- o Quality Control Report

Samples 027367-0001 and -0002 were diluted for Method 8240 due to the presence of target compounds in excess of the linear range. The reporting limits have been adjusted relative to the required dilution.

Butanol was searched for by mass chromatogram and was not detected in any of the samples.

## Sample Description Information

The Sample Description Information lists all of the samples received in this project together with the internal laboratory identification number assigned for each sample. Each project received at Enseco - RMAL is assigned a unique six digit number. Samples within the project are numbered sequentially. The laboratory identification number is a combination of the six digit project code and the sample sequence number.

Also given in the Sample Description Information is the Sample Type (matrix), Date of Sampling (if known) and Date of Receipt at the laboratory.

## Analytical Test Requests

The Analytical Test Requests lists the analyses that were performed on each sample. The Custom Test column indicates where tests have been modified to conform to the specific requirements of this project.



SAMPLE DESCRIPTION INFORMATION  
for  
Woodward Clyde Consultants

Lab ID	Client ID	Matrix	Sampled Date	Time	Received Date
027367-0001-SA	MW-13A	AQUEOUS	27 JAN 93	08:15	28 JAN 93
027367-0002-SA	MW-13	AQUEOUS	27 JAN 93	08:30	28 JAN 93
027367-0003-SA	MW-13B	AQUEOUS	27 JAN 93	08:45	28 JAN 93
027367-0004-TB	TRIP BLANK	AQUEOUS	27 JAN 93		28 JAN 93



ANALYTICAL TEST REQUESTS  
for  
Woodward Clyde Consultants

Lab ID:	Group Code	Analysis Description	Custom Test?
027367			
0001 - 0004	A	Volatile Organics	Y
		Target Compound List (TCL)	Y
		Screen - Volatile Organics	N



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-13A

Lab ID: 027367-0001-SA

Matrix: AQUEOUS

Authorized: 28 JAN 93

Sampled: 27 JAN 93

Prepared: 01 FEB 93

Received: 28 JAN 93

Analyzed: 03 FEB 93

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	500
Benzene	ND	ug/L	250
Bromodichloromethane	ND	ug/L	250
Bromoform	ND	ug/L	250
Bromomethane	ND	ug/L	500
2-Butanone (MEK)	ND	ug/L	500
Carbon disulfide	ND	ug/L	250
Carbon tetrachloride	ND	ug/L	250
Chlorobenzene	ND	ug/L	250
Chloroethane	ND	ug/L	500
Chloroform	ND	ug/L	250
Chloromethane	ND	ug/L	500
Dibromochloromethane	ND	ug/L	250
1,1-Dichloroethane	ND	ug/L	250
1,2-Dichloroethane	ND	ug/L	250
1,1-Dichloroethene	ND	ug/L	250
1,2-Dichloroethene	ND	ug/L	250
(total)	ND	ug/L	250
1,2-Dichloropropane	ND	ug/L	250
cis-1,3-Dichloropropene	ND	ug/L	250
trans-1,3-Dichloropropene	ND	ug/L	250
Ethylbenzene	2800	ug/L	250
2-Hexanone	ND	ug/L	500
Methylene chloride	ND	ug/L	250
4-Methyl-2-pentanone	ND	ug/L	500
(MIBK)	ND	ug/L	250
Styrene	ND	ug/L	250
1,1,2,2-Tetrachloroethane	ND	ug/L	250
Tetrachloroethene	ND	ug/L	250
Toluene	ND	ug/L	250
1,1,1-Trichloroethane	ND	ug/L	250
1,1,2-Trichloroethane	ND	ug/L	250
Trichloroethene	ND	ug/L	250
Vinyl acetate	ND	ug/L	500
Vinyl chloride	ND	ug/L	500
Xylenes (total)	9800	ug/L	250
Hexane	ND	ug/L	250

Surrogate	Recovery	
Toluene-d8	102	%

(continued on following page)

ND = Not detected  
NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-13A

Lab ID: 027367-0001-SA

Matrix: AQUEOUS

Authorized: 28 JAN 93

Sampled: 27 JAN 93

Prepared: 01 FEB 93

Received: 28 JAN 93

Analyzed: 03 FEB 93

Surrogate

Recovery

4-Bromofluorobenzene  
1,2-Dichloroethane-d4

96	%
109	%

ND = Not detected  
NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
 Target Compound List (TCL)  
 Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-13

Lab ID: 027367-0002-SA

Matrix: AQUEOUS

Authorized: 28 JAN 93

Sampled: 27 JAN 93

Prepared: 01 FEB 93

Received: 28 JAN 93

Analyzed: 03 FEB 93

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	5000
Benzene	ND	ug/L	2500
Bromodichloromethane	ND	ug/L	2500
Bromoform	ND	ug/L	2500
Bromomethane	ND	ug/L	5000
2-Butanone (MEK)	ND	ug/L	5000
Carbon disulfide	ND	ug/L	2500
Carbon tetrachloride	ND	ug/L	2500
Chlorobenzene	ND	ug/L	2500
Chloroethane	ND	ug/L	5000
Chloroform	ND	ug/L	2500
Chloromethane	ND	ug/L	5000
Dibromochloromethane	ND	ug/L	2500
1,1-Dichloroethane	ND	ug/L	2500
1,2-Dichloroethane	ND	ug/L	2500
1,1-Dichloroethene	ND	ug/L	2500
1,2-Dichloroethene	ND	ug/L	2500
(total)	ND	ug/L	2500
1,2-Dichloropropane	ND	ug/L	2500
cis-1,3-Dichloropropene	ND	ug/L	2500
trans-1,3-Dichloropropene	ND	ug/L	2500
Ethylbenzene	ND	ug/L	2500
2-Hexanone	ND	ug/L	5000
Methylene chloride	63000	ug/L	2500
4-Methyl-2-pentanone	ND	ug/L	5000
(MIBK)	ND	ug/L	2500
Styrene	ND	ug/L	2500
1,1,2,2-Tetrachloroethane	ND	ug/L	2500
Tetrachloroethene	ND	ug/L	2500
Toluene	19000	ug/L	2500
1,1,1-Trichloroethane	ND	ug/L	2500
1,1,2-Trichloroethane	ND	ug/L	2500
Trichloroethene	4300	ug/L	2500
Vinyl acetate	ND	ug/L	5000
Vinyl chloride	ND	ug/L	5000
Xylenes (total)	3000	ug/L	2500
Hexane	ND	ug/L	2500
Surrogate	Recovery		
Toluene-d8	100	%	

(continued on following page)

ND = Not detected  
 NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-13

Lab ID: 027367-0002-SA

Matrix: AQUEOUS

Authorized: 28 JAN 93

Sampled: 27 JAN 93

Prepared: 01 FEB 93

Received: 28 JAN 93

Analyzed: 03 FEB 93

Surrogate

Recovery

4-Bromofluorobenzene

95 %

1,2-Dichloroethane-d4

106 %

ND = Not detected  
NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
 Target Compound List (TCL)  
 Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-13B

Lab ID: 027367-0003-SA

Matrix: AQUEOUS

Authorized: 28 JAN 93

Sampled: 27 JAN 93

Prepared: 01 FEB 93

Received: 28 JAN 93

Analyzed: 02 FEB 93

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	10
Benzene	ND	ug/L	5.0
Bromodichloromethane	ND	ug/L	5.0
Bromoform	ND	ug/L	5.0
Bromomethane	ND	ug/L	10
2-Butanone (MEK)	ND	ug/L	10
Carbon disulfide	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Chloroethane	ND	ug/L	10
Chloroform	ND	ug/L	5.0
Chloromethane	ND	ug/L	10
Dibromochloromethane	ND	ug/L	5.0
1,1-Dichloroethane	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	5.0
1,2-Dichloroethene	ND	ug/L	5.0
(total)	ND	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Ethylbenzene	ND	ug/L	5.0
2-Hexanone	ND	ug/L	10
Methylene chloride	5.9	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	10
(MIBK)	ND	ug/L	5.0
Styrene	ND	ug/L	5.0
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0
Tetrachloroethene	ND	ug/L	5.0
Toluene	ND	ug/L	5.0
1,1,1-Trichloroethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Trichloroethene	7.6	ug/L	5.0
Vinyl acetate	ND	ug/L	10
Vinyl chloride	ND	ug/L	10
Xylenes (total)	ND	ug/L	5.0
Hexane	ND	ug/L	5.0

Surrogate Recovery

Toluene-d8 101 %

(continued on following page)

ND = Not detected  
 NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: MW-13B

Lab ID: 027367-0003-SA

Matrix: AQUEOUS

Authorized: 28 JAN 93

Sampled: 27 JAN 93

Prepared: 01 FEB 93

Received: 28 JAN 93

Analyzed: 02 FEB 93

Surrogate

Recovery

4-Bromofluorobenzene

95 %

1,2-Dichloroethane-d4

103 %

ND = Not detected  
NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants

Client ID: TRIP BLANK

Lab ID: 027367-0004-TB

Matrix: AQUEOUS

Authorized: 28 JAN 93

Sampled: 27 JAN 93

Prepared: 01 FEB 93

Received: 28 JAN 93

Analyzed: 01 FEB 93

Parameter	Result	Units	Reporting Limit
Acetone	ND	ug/L	10
Benzene	ND	ug/L	5.0
Bromodichloromethane	ND	ug/L	5.0
Bromoform	ND	ug/L	5.0
Bromomethane	ND	ug/L	10
2-Butanone (MEK)	ND	ug/L	10
Carbon disulfide	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Chloroethane	ND	ug/L	10
Chloroform	ND	ug/L	5.0
Chloromethane	ND	ug/L	10
Dibromochloromethane	ND	ug/L	5.0
1,1-Dichloroethane	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	5.0
1,2-Dichloroethene	ND	ug/L	5.0
(total)	ND	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Ethylbenzene	ND	ug/L	5.0
2-Hexanone	ND	ug/L	10
Methylene chloride	5.1	ug/L	5.0
4-Methyl-2-pentanone	ND	ug/L	10
(MIBK)	ND	ug/L	5.0
Styrene	ND	ug/L	5.0
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0
Tetrachloroethene	ND	ug/L	5.0
Toluene	ND	ug/L	5.0
1,1,1-Trichloroethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0
Vinyl acetate	ND	ug/L	10
Vinyl chloride	ND	ug/L	10
Xylenes (total)	ND	ug/L	5.0
Hexane	ND	ug/L	5.0

Surrogate	Recovery	
Toluene-d8	98	%

(continued on following page)

ND = Not detected  
NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



Volatile Organics  
Target Compound List (TCL)  
Method 8240

Client Name: Woodward-Clyde Consultants  
Client ID: TRIP BLANK  
Lab ID: 027367-0004-TB  
Matrix: AQUEOUS  
Authorized: 28 JAN 93

Sampled: 27 JAN 93  
Prepared: 01 FEB 93

Received: 28 JAN 93  
Analyzed: 01 FEB 93

Surrogate

Recovery

4-Bromofluorobenzene	102	%
1,2-Dichloroethane-d4	97	%

ND = Not detected  
NA = Not applicable

Reported By: Steven Francis

Approved By: Audrey Verniero



QC LOT ASSIGNMENT REPORT  
Volatile Organics by GC/MS

Laboratory Sample Number	QC Matrix	QC Category	QC Lot Number (DCS)	QC Run Number (SCS/BLANK)
027367-0001-SA	AQUEOUS	624-A	02 FEB 93-E	03 FEB 93-E
027367-0002-SA	AQUEOUS	624-A	02 FEB 93-E	03 FEB 93-E
027367-0003-SA	AQUEOUS	624-A	02 FEB 93-E	02 FEB 93-E
027367-0004-TB	AQUEOUS	624-A	29 JAN 93-E	01 FEB 93-E



DUPLICATE CONTROL SAMPLE REPORT  
Volatile Organics by GC/MS

Analyte	Spiked	Concentration		AVG	Accuracy		Precision	
		DCS1	Measured DCS2		Average(%)	DCS Limits	(RPD)	DCS Limit
Category: 624-A								
Matrix: AQUEOUS								
QC Lot: 02 FEB 93-E								
Concentration Units: ug/L								
1,1-Dichloroethene	50	41.0	41.4	41.2	82	56-138	1.0	20
Trichloroethene	50	42.8	42.4	42.6	85	76-109	0.9	13
Benzene	50	40.0	40.8	40.4	81	78-119	2.0	12
Toluene	50	44.5	44.9	44.7	89	82-114	0.9	13
Chlorobenzene	50	43.8	44.6	44.2	88	84-117	1.8	10

Category: 624-A  
Matrix: AQUEOUS  
QC Lot: 29 JAN 93-E  
Concentration Units: ug/L

1,1-Dichloroethene	50	54.3	53.9	54.1	108	56-138	0.7	20
Trichloroethene	50	52.8	53.7	53.2	107	76-109	1.7	13
Benzene	50	48.7	49.7	49.2	98	78-119	2.0	12
Toluene	50	53.4	53.2	53.3	107	82-114	0.4	13
Chlorobenzene	50	48.8	48.4	48.6	97	84-117	0.8	10

Calculations are performed before rounding to avoid round-off errors in calculated results.



SINGLE CONTROL SAMPLE REPORT  
Volatile Organics by GC/MS

Analyte	Concentration Spiked	Concentration Measured	Accuracy(%) SCS	Limits
---------	-------------------------	---------------------------	--------------------	--------

Category: 624-A  
Matrix: AQUEOUS  
QC Lot: 02 FEB 93-E    QC Run: 03 FEB 93-E  
Concentration Units: ug/L

1,2-Dichloroethane-d4	50.0	55.3	111	82-112
4-Bromofluorobenzene	50.0	48.3	97	83-113
Toluene-d8	50.0	49.8	100	90-112

Category: 624-A  
Matrix: AQUEOUS  
QC Lot: 02 FEB 93-E    QC Run: 02 FEB 93-E  
Concentration Units: ug/L

1,2-Dichloroethane-d4	50.0	51.9	104	82-112
4-Bromofluorobenzene	50.0	48.5	97	83-113
Toluene-d8	50.0	50.0	100	90-112

Category: 624-A  
Matrix: AQUEOUS  
QC Lot: 29 JAN 93-E    QC Run: 01 FEB 93-E  
Concentration Units: ug/L

1,2-Dichloroethane-d4	50.0	51.3	103	82-112
4-Bromofluorobenzene	50.0	50.0	100	83-113
Toluene-d8	50.0	47.4	95	90-112

Calculations are performed before rounding to avoid round-off errors in calculated results.



**METHOD BLANK REPORT**  
 Volatile Organics by GC/MS

Analyte	Result	Units	Reporting Limit	
Test: 8240CP-TCL-AP				
Matrix: AQUEOUS				
QC Lot: 02 FEB 93-E      QC Run: 03 FEB 93-E				
Acetone	8.5	ug/L	10	J
Benzene	ND	ug/L	5.0	
Bromodichloromethane	ND	ug/L	5.0	
Bromoform	ND	ug/L	5.0	
Bromomethane	ND	ug/L	10	
2-Butanone (MEK)	3.8	ug/L	10	J
Carbon disulfide	ND	ug/L	5.0	
Carbon tetrachloride	ND	ug/L	5.0	
Chlorobenzene	ND	ug/L	5.0	
Chloroethane	ND	ug/L	10	
Chloroform	ND	ug/L	5.0	
Chloromethane	ND	ug/L	10	
Dibromochloromethane	ND	ug/L	5.0	
1,1-Dichloroethane	ND	ug/L	5.0	
1,2-Dichloroethane	ND	ug/L	5.0	
1,1-Dichloroethene	ND	ug/L	5.0	
1,2-Dichloroethene	ND	ug/L	5.0	
(total)	ND	ug/L	5.0	
1,2-Dichloropropane	ND	ug/L	5.0	
cis-1,3-Dichloropropene	ND	ug/L	5.0	
trans-1,3-Dichloropropene	ND	ug/L	5.0	
Ethylbenzene	ND	ug/L	5.0	
2-Hexanone	ND	ug/L	10	
Methylene chloride	3.3	ug/L	5.0	J
4-Methyl-2-pentanone				
(MIBK)	ND	ug/L	10	
Styrene	ND	ug/L	5.0	
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0	
Tetrachloroethene	ND	ug/L	5.0	
Toluene	ND	ug/L	5.0	
1,1,1-Trichloroethane	ND	ug/L	5.0	
1,1,2-Trichloroethane	ND	ug/L	5.0	
Trichloroethene	ND	ug/L	5.0	
Vinyl acetate	ND	ug/L	10	
Vinyl chloride	ND	ug/L	10	
Xylenes (total)	ND	ug/L	5.0	
Hexane	ND	ug/L	5.0	

J = Result is detected below the reporting limit or is an estimated concentration.



METHOD BLANK REPORT  
Volatile Organics by GC/MS (cont.)

Analyte	Result	Units	Reporting Limit
Test: 8240CP-TCL-AP			
Matrix: AQUEOUS			
QC Lot: 02 FEB 93-E    QC Run: 02 FEB 93-E			
Acetone	ND	ug/L	10
Benzene	ND	ug/L	5.0
Bromodichloromethane	ND	ug/L	5.0
Bromoform	ND	ug/L	5.0
Bromomethane	ND	ug/L	10
2-Butanone (MEK)	ND	ug/L	10
Carbon disulfide	ND	ug/L	5.0
Carbon tetrachloride	ND	ug/L	5.0
Chlorobenzene	ND	ug/L	5.0
Chloroethane	ND	ug/L	10
Chloroform	ND	ug/L	5.0
Chloromethane	ND	ug/L	10
Dibromochloromethane	ND	ug/L	5.0
1,1-Dichloroethane	ND	ug/L	5.0
1,2-Dichloroethane	ND	ug/L	5.0
1,1-Dichloroethene	ND	ug/L	5.0
1,2-Dichloroethene	ND	ug/L	5.0
(total)	ND	ug/L	5.0
1,2-Dichloropropane	ND	ug/L	5.0
cis-1,3-Dichloropropene	ND	ug/L	5.0
trans-1,3-Dichloropropene	ND	ug/L	5.0
Ethylbenzene	ND	ug/L	5.0
2-Hexanone	ND	ug/L	10
Methylene chloride	2.5	ug/L	5.0
4-Methyl-2-pentanone			
(MIBK)	ND	ug/L	10
Styrene	ND	ug/L	5.0
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0
Tetrachloroethene	ND	ug/L	5.0
Toluene	ND	ug/L	5.0
1,1,1-Trichloroethane	ND	ug/L	5.0
1,1,2-Trichloroethane	ND	ug/L	5.0
Trichloroethene	ND	ug/L	5.0
Vinyl acetate	ND	ug/L	10
Vinyl chloride	ND	ug/L	10
Xylenes (total)	ND	ug/L	5.0
Hexane	ND	ug/L	5.0

J = Result is detected below the reporting limit or is an estimated concentration.



METHOD BLANK REPORT  
Volatile Organics by GC/MS (cont.)

Analyte	Result	Units	Reporting Limit	
Test: 8240CP-TCL-AP				
Matrix: AQUEOUS				
QC Lot: 29 JAN 93-E QC Run: 01 FEB 93-E				
Acetone	5.2	ug/L	10	J
Benzene	ND	ug/L	5.0	
Bromodichloromethane	ND	ug/L	5.0	
Bromoform	ND	ug/L	5.0	
Bromomethane	ND	ug/L	10	
2-Butanone (MEK)	ND	ug/L	10	
Carbon disulfide	ND	ug/L	5.0	
Carbon tetrachloride	ND	ug/L	5.0	
Chlorobenzene	ND	ug/L	5.0	
Chloroethane	ND	ug/L	10	
Chloroform	ND	ug/L	5.0	
Chloromethane	ND	ug/L	10	
Dibromochloromethane	ND	ug/L	5.0	
1,1-Dichloroethane	ND	ug/L	5.0	
1,2-Dichloroethane	ND	ug/L	5.0	
1,1-Dichloroethene	ND	ug/L	5.0	
1,2-Dichloroethene	ND	ug/L	5.0	
(total)	ND	ug/L	5.0	
1,2-Dichloropropane	ND	ug/L	5.0	
cis-1,3-Dichloropropene	ND	ug/L	5.0	
trans-1,3-Dichloropropene	ND	ug/L	5.0	
Ethylbenzene	ND	ug/L	5.0	
2-Hexanone	ND	ug/L	10	
Methylene chloride	3.0	ug/L	5.0	J
4-Methyl-2-pentanone				
(MIBK)	ND	ug/L	10	
Styrene	ND	ug/L	5.0	
1,1,2,2-Tetrachloroethane	ND	ug/L	5.0	
Tetrachloroethene	ND	ug/L	5.0	
Toluene	ND	ug/L	5.0	
1,1,1-Trichloroethane	ND	ug/L	5.0	
1,1,2-Trichloroethane	ND	ug/L	5.0	
Trichloroethene	ND	ug/L	5.0	
Vinyl acetate	ND	ug/L	10	
Vinyl chloride	ND	ug/L	10	
Xylenes (total)	ND	ug/L	5.0	
Hexane	1.0	ug/L	5.0	J

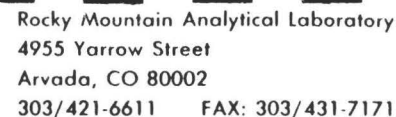
J = Result is detected below the reporting limit or is an estimated concentration.





# Appendix





ENSECO CLIENT  
Woodward - Clyde Consultants

PROJECT Sheller Globe 91C7343

SAMPLING COMPANY  
W C C

SAMPLING SITE 3200 Main

TEAM LEADER Gene Papinako

PACKED BY Horne Payson

SEAL INTACT UPON RECEIPT BY SAMPLING COMPANY

SEAL FOR SHIPPING BY

SEAL NUMBER

SAMPLING STATUS	
1	2
3	4
5	6
7	8
9	10
11	12
13	14
15	16
17	18
19	20
21	22
23	24
25	26
27	28
29	30
31	32
33	34
35	36
37	38
39	40
41	42
43	44
45	46
47	48
49	50
51	52
53	54
55	56
57	58
59	60
61	62
63	64
65	66
67	68
69	70
71	72
73	74
75	76
77	78
79	80
81	82
83	84
85	86
87	88
89	90
91	92
93	94
95	96
97	98
99	100

☐ Done☐ Continuing Until

SEAL INTACT UPON RECEIPT BY LAB

☒ Yes☐ No

CONTENTS TEMPERATURE UPON RECEIPT BY LAB

5.3 °C

## CUSTODY TRANSFERS PRIOR TO SHIPPING

## SHIPPING DETAILS

RELINQUISHED BY (SIGNED)

RECEIVED BY (SIGNED)

DATE \_\_\_\_\_

## TIME

DELIVERED TO SHIPPER BY

METHOD OF SHIPMENT	
--------------------	--

Fed Ex

AIRBILL NUMBER	
----------------	--

RECEIVED FOR LAB

**SIGNED**

ENSECO PROJECT NUMBER

DATE/TIME

09:34